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American Branch Factories Abroad

By Dr. Julius Klein

Assistant Secretary of Commerce

FOR MANY DECADES American industrial establishments have been operating in foreign countries, but less than half a dozen concerns had made any considerable headway before 1914. Since the war, however, the movement has acquired an entirely new significance. Though much of the recent discussion is in terms of relationship to our own tariff policy, the movement is far broader than this restricted phase. It takes on the proportions of permanent American economic aggrandizement, and is, in some respects, comparable to a similar world-wide projection of British industry a generation or more ago. It is not simply a by-product of the tariff issue, nor of the pressure of foreign competition in international trade; it is not necessarily a search for cheap labor abroad. It may, broadly speaking, be described as the latest phase or symbol of American power in the industrial world.

The question has been brought sharply to the fore within the last few weeks by the Senate draft of the tariff bill which includes a clause prohibiting importation of goods made abroad under American patents or with American trademarks. This provision is said to have been proposed by representatives of labor, who have naturally been gravely concerned over the expansion of factories abroad and particularly over recent imports from the Ford tractor plant at Cork, Ireland. These have come in without payment of tariff as "agricultural implements" exempt from duty. Since the domestic tractor works of the Ford Company have been practically shut down, this new development has aroused labor circles. The above mentioned clause in the Tariff Act is said to be one result of that anxiety.

In connection with this problem queries have been coming to the Department of Commerce of late from industrial executives in all parts of the country. Many of them, anticipating a lull in domestic demand or modified growth in home trade, are confronted with the necessity of developing overseas outlets. Soon or late they stumble upon the thought that foreign branch factories might be an effective step into the foreign market, that the exportation of American production instead of products might be a solution. They discover that in Canada alone there are already nearly 1,000 branch factories, that more than 200 American companies are maintaining 2,000 establishments of this sort abroad.

The amounts of American capital thus engaged have been variously estimated. If we draw a line between extractive and manipulates activities, if we eliminate mining companies in Mexico, sugar centrals in Cuba, pulp forests in Canada, nitrate plants in Chile (about half of which are owned by Americans), and confine our tabulations to manufacturing enterprises owned wholly or in substantial part by Americans, the total will probably exceed 1.3 billion dollars. About half of these are completely under American control. They range in activity from the packing industry in the Argentine, nearly three-fifths of which is American, to textile mills in Peru; from shoe factories in Mexico to jute mills in India and cotton mills in China; from telephone equipment factories in Spain to automobile plants in Belgium.

The branch factory movement is indeed one of amazing complexity. It is neither wholly good nor wholly bad. Before reaching any decision, one must scrutinize many vital details. The failure to observe this truth has caused much misery among otherwise far-sighted and potent American industrialists who have rushed into hasty openings of such plants and have repented at leisure.

In the beginning, the earliest incentives stimulating

the opening of plants abroad were the saving of transportation costs and the forestalling of possible native competition. This figured in the early invasion by American packers in the Argentine as it did in the overseas expansion of the British cotton goods industry, which endeavored to forestall competition from cotton manufacturing plants in Brazil, India, and elsewhere.

In more recent years as our export interest increased, as in the automotive industry, the requirements of foreign patent laws have been a factor. Most of these have the so-called "working clause" requiring manufacture in the country granting the patent, a stipulation for which there has been much agitation in this country.

Another major influence bearing upon this situation was the world-wide post-war insistence upon "economic self-sufficiency." This understandable nationalistic aspiration had a great deal to do with the upward shifting of the tariffs of some forty countries and caused the establishment of new industrial undertakings within their borders. Numerous similar devices were undertaken with the same purpose—readjustments of tax schedules to favor plant expansion, the fixing of import quotas and other trade controls. All these were used to encourage importation of plants rather than of products, thus to take up the heavy slack of unemployment after demobilization and to fill depleted national exchequers.

"With reference to this whole question of supposed wage advantage [in foreign countries], it would seem superfluous to point out that low wage rates are by no means an indicator of low labor costs."

The issue, then, is fraught with highly contentious aspects. It is not only inexpedient but impossible to arrive at any flat decision that branch plants are wholly right or wholly wrong. This, therefore, must necessarily be an "ambidexterous" survey, an "on the one hand and on the other affair." It is of utmost importance that all possible aspects be viewed with gravest care. The problem merits long-view thinking and a careful appraisal of the hidden factors which lie behind overseas operations.

Let's take the exports of two companies in widely different lines. The manufacturer of the Excelsior toothless comb had developed a lucrative export market in a Latin American country. But native competitors became ambitious and were soon able to persuade their government to defend them with a practically prohibitive tariff. Three courses of action thus lay open to the American company: (1) to abandon the market and turn to other unhampered fields; (2) to take over the native factories; (3) to set up a local branch factory. The third course was decided upon after a brief, hectic session of the Board of Directors whose chief emotion in the matter apparently was one of profound contempt for their "greaser competitors." Such vital matters as the possibilities of shifting wage scales (and this was a country chronically seething with labor unrest), the prospect of taxation increases (once again quite evidently on account of the radical, distinctly anti-foreign government in charge), and the accessibility of raw materials, were overlooked. On each they met with serious trouble, which finally brought about the withdrawal of the whole enterprise—a humiliating outcome to their pugnacious pronouncements. It was an expensive lesson on the folly of failing to stop, look, and listen.

Exhibit B is a large manufacturer of noiseless alarm clocks, whose sales executives were harassed by shipping irregularities, by costly long-distance servicing, and by a new tariff policy of a labor government. A branch was set up in that market. All went well for a while, until the hostility of less efficient native competitors—and that has been frequently the stumbling block for the American intruder in foreign industrial fields—stirred local politicians to interpose harassing restrictions upon the American interloper. He had been assured of "generous consideration" in the tariff schedule by federal authorities, but he overlooked the fact that provincial officials had something to say about export taxes. And these were promptly marshalled to strangle the new enterprise. Interested official friends of native competitors resorted to the old device of altering the classification of incoming supplies, certain of which were found to be outside the privileged low-rate categories because "susceptible of sale as finished products" and not necessarily destined exclusively as parts for assemblage in the new factory. There followed the usual long and acrimonious wrangle, the stubborn refusal of the American manufacturers to distribute "lawyers' fees" in generous handfuls in various directions. Finally the matter culminated in a prolonged shut-down of the plant, which was not broken until the U. S. Department of Commerce representatives brought on an informal arbitration. This resulted in a more nearly satisfactory agreement, one which should have been worked out carefully at the very beginning.

It might be helpful to marshall the respective pros and cons of this problem. First, then, the pros, in terms of advantage to the United States as a whole:

1. The development of American branch factories abroad stimulates exports of American machinery. In 1928 our sales of machinery abroad exceeded 206 million dollars, which represented almost double the amount sold in 1922. Just how much went into branch factories is impossible to determine, but the increase has been explained both by the direct demands of the branches and by their influence on native competitors.

Perhaps the greater proportion of our machinery exports to Canada (our leading export market therefor, totaling 50 millions in 1928 against 24 millions in 1923) goes to American branches. France has advanced from 12th to 4th place in the list of our foreign machinery customers.

Where once we shipped completed goods to foreign merchants and consumers, we now ship supplies and machinery and accessories. Where one company shipped raincoats to South America, it now ships rubberized cloth and other materials to a greater dollar total. Where we shipped tires to Australia, and railroad cars to Brazil, we now ship tire fabric, carbon black, air brake equipment, wheels, and couplers.

2. Branch plants with advanced labor policies raise local standards of living and general buying power, as witness Chile. It is, of course, quite out of the question for any American industry to introduce sweeping wage improvements and other drastic innovations in older parts of the world. Nevertheless, though age-long social and political obstacles stand in the way, the American newcomer sets a salutary example. Increased comfort and buying power has come to many a native worker

with many consequent benefits to American exporters.

3. Branches are often the only means of securing business behind high tariff walls. Where prohibitive tariffs are shaped especially to keep out foreign competitors, as in various dominions and colonies of the British Empire, branch plants are grim necessities. In South Africa, where Imperial preference duties are taken most seriously and where it is evident that native industries will develop in any event, American executives have even found it expedient to take over control and to guide native industries into less competitive fields.

Tariffs change more often by classification than by rate. When American automobile assembling plants were first set up in Germany, the parts and sub-assemblies were classed as "bulk iron and steel." Since they are now classed as highly finished parts, many more of them are made in Germany. By an adroit juggling of classifications, the German authorities have thus taken a reef in their unemployment.

Though the migration of American industries to Canada has been motivated by a sincere desire for improved service to the Canadian market, branch plants can operate more profitably behind the tariff wall and can reach out much more advantageously to other markets within the British Empire. Though the extreme program of Imperial preference proposed by Sir Alfred Mond, now Lord Melchett, will probably never be carried out in full, our branch plants in Canada have a decided advantage over plants operating within and from the United States. Operations within and from Canada are likely to be sharply accelerated in the near future.

4. Lower wage rates in foreign lands are frequently a determinant in the competitive struggle. In general, however, American competitive effort is based on quality rather than price. Just recently a large American electrical manufacturer was soundly criticized for fabricating an equipment order for Latin America in its branch plant in Japan. The order was highly competitive and closely priced. The manufacturer made a profit in Japan as against almost sure loss at home.

"The issue is fraught with highly contentious aspects. It is not only inexpedient but impossible to arrive at any flat decision that branch plants are wholly right or wholly wrong."

5. Savings in freight rates. Thus the automotive industries have built assembling plants all over the world. Corollary to freight savings are savings from deterioration of highly perishable products like confectionery, chewing gum, and ice cream.

6. "Nationalistic propaganda." Though the propagandists may find it difficult to persuade natives to "buy native" and thus to entwine patriotism with profits, governmental buying agencies do prefer native products. In connection with the telephone concession awarded by Spain to an American organization, there were definite stipulations that a large portion of the equipment be made in Spain.

In many instances, indeed, American parent companies have dropped American names for names conspicuously native and have appointed native executives.

Let us now turn to the "cons," the arguments usually marshalled against branches in foreign countries:

1. In the first place, it is cited that this development unmistakably will curtail our commerce. Even though the actual result will more probably be a rearrangement of our trade rather than a reduction, certain industries will suffer drastic hardships. When a branch is used for export into third countries, the movement assumes an almost ominous significance. If American tire factories in Canada export tires to South America, the American worker has less work. The statistics are disconcerting, because, while our tire exports to South America were doubling from 1924 to 1928, Canadian tire exports were enjoying a five-fold increase. In 1929, it looks as if Canada will enjoy more tire business from South America than will the United States. Though it is true that all tire plants in Canada are American-owned, with some consequent benefit to American stockholders, American taxes and American workers are bound to lose heavily.

And we find similar situations in the rubber shoe and boot industry, in the Singer Sewing Machine industry which carries on most of its export from Dundee, Scotland, in meat packing, and many other industries. It would seem, therefore, highly desirable that American executives avoid establishing foreign branch plants to compete with home industries.

2. Diplomatic and political complications arising from overseas enterprises are problems of utmost gravity. Though this is a risk inherent in any overseas investment, it is true that some foreign governments sometimes do vent their anti-American animosities on American branch plants. England has contended with anti-English feeling for generations. We must resign ourselves to native diatribes (especially in Latin America) against "imperialistic intrusions of the Colossus of the North."

There have, in fact, been occasions when overseas enterprises have brought on entanglements. Some historians are quite certain that the Spanish-American War was motivated more by the influence of owners of Cuban sugar properties than by any altruistic ardor for Cuban liberty. Certain American branches in China are now languishing and repenting at leisure. It is a discouraging commentary upon the discretion and foresight of some American executives that many such foreign enterprises are launched. The administration in Washington is assaulted periodically with mournful cries for help. Executives decide to "take a chance," and then, having lost, expect the administration to come to their rescue.

3. Foreign tariffs are subject to rapid revisions. Unlike those of the United States, they can more often than not be altered by executive decree rather than parliamentary deliberation. This means that today's tariff advantages may be tomorrow's handicaps.

4. The same applies to alterations in labor laws, a particularly dangerous element. Since many radical governments are now in power in various parts of the world, industrialists are all the more subject to the aggravations of unemployment social insurance schemes, worker's pensions, employer's liability, and the like.

With reference to the whole question of supposed wage advantage, it would seem superfluous to point out that low wage rates are by no means an indicator of low labor costs. Labor cost per unit of output must be distinguished from labor cost per hour of day. Though German wages are only about one-third of those in this country, the German worker, less amply equipped, produces less than one-third of the dollar value of his

American competitor. Without venturing into the highly inflammatory prohibition question, it must be conceded that fewer Monday accidents and not so many convivial week-end holidays do heighten American labor efficiency.

5. Supposed advantages of market proximity sometimes vanish when unexpected obstacles bob up. If an automobile factory is set up in Austria, for example, it will enjoy a central distributing point for Middle Europe, but it will encounter high tariff walls in every direction. Until these tariffs and nationalistic animosities are cleared away, the establishment of a branch factory there is fraught with dire disabilities.

6. High taxation in foreign countries. Any industrial venture must expect at least to bear its share of war debts, reparations obligations, heavy armaments, and other accessories to the ancient European game of diplomacy.

7. American mass production methods cannot easily be projected into foreign plants. The attempt to project them means an encounter with the slow-moving traditions of individual skill and craftsmanship, psychological and historical barriers of formidable proportions. Occasional monetary success may be achieved, but the long view prospect must be weighed. The experience of a certain American concern which tried to speed up their English workmen must be remembered. The concern was placarded throughout the nation as a "ruthless slave driver." They found markets barred against them and were finally forced to ignominious retreat.

For like reasons, even the British Leverhulme soap interests were forced to withdraw from Japan and sell their plants to Japanese interests.

These, then, are a few of the more conspicuous arguments on both sides of a highly contentious question. It is indeed most dangerous to come to any snap judgment on so serious a problem. In international economics, it is essential that those charged with final decision penetrate far into the background of each aspect. Though this seems a totally unnecessary observation, repeated disasters seem to suggest emphatic insistence. The only way to avoid costly blunders is the well tried process of thorough and exhaustive actual analysis. Let us be assured that American branches are established with sobriety and calm judgment.

Economists argue that if American industrial technique is good, its export will develop better industrial conditions abroad. This should mean higher living standards and better export trade "in the long run," but American workmen will reply, "all wage earners are not Marathon runners." It was hard for Massachusetts workmen to be overjoyed when their jute mill was loaded bodily onto a freighter, transported to India, and their jobs given to Hindu workmen. Though every industrial dislocation is apt to involve personal hardship we must avoid unnecessary distress through thoughtless ventures into foreign fields.

Cracking and breaking of bearing metals in bearings under impact or pounding may result from two causes, either the alloy being too brittle or the metal was poured too cold. In the former case, the brittleness may be due to oxide contained in the alloy or to an excess of antimony or copper. On the other hand, if the metal is poured too cold, the casting or bearing will usually be full of waves, flakes, and blow holes.

SEEN · AND · HEARD

By JOHN R. GODFREY

Changes in Shop Facilities—Two Drawers in Benches—Standard Machines?

THERE have been numerous changes in facilities provided for workers washing up after the day's work is over. The old shop had a common wash trough or individual wooden bucket. There was rarely any hot water available and soaps especially devised for removing grease were not on the market. Then came the individual enameled iron wash bowls, usually mounted in long rows on cast iron legs and with provisions for hot and cold water. Now we go back to the common wash trough but of entirely different construction. A large round basin, moulded of attractive cement composition, is provided with a central spray that reaches all around the basin and can accomodate a dozen men. The temperature of the spray, of course, can be regulated to suit, and this combination seems to be gaining favor.

Another modern feature in shops covering large areas is to put lavatories in or near each department. This saves a lot of time during a year, makes it unnecessary for a worker to leave his department and prevents unnecessary visiting during working hours.

* * * *

WHERE two shifts are used in any plant the question of individual tools is frequently troublesome to some extent. One large plant solves this by providing all its work benches with two drawers. This gives the day and night workers separate drawers and avoids all disputes as to tool damage or disappearance. In this case the benches had to be specially ordered. They might well become a standard product.

* * * *

STANDARDIZATION, like all other good ideas, must be applied with strong doses of common sense or it can become a menance rather than a benefit. The standardized milling machine spindle end, for example, has proved of great value to users and they are fully justified in adhering to it until a better design is found, and is adopted as a standard. But any user who insists that all future machines be exactly like those he is now buying in every other detail, is likely to deprive himself of improvements that are made from time to time by any progressive machine builder.

Whenever I hear any production man say he has standardized on any particular type or make of machine, I wonder whether he means for the present season or for a five-year period. If it is the latter, he is in danger of getting into a rut that gets deeper the longer you stay in it.

Standardization can be a great help in many ways, but it can also cause stagnation. It all depends on the way in which it is used.

Controlling Production Costs in the Small Shop

By E. A. Terrell
The Terrell Machine Company, Inc.

Method of assigning jobs to workmen—Distribution of different classes of labor—Keeping costs of parts—Invoices, shipping orders and other forms

WHILE the labor charges on work orders have been mentioned, the source of this information has not been stated. The daily time card is shown in Fig. 12. In it spaces are provided for the work-order number, the operation number, the earnings, the elapsed time, and the clock record. At the end of each day the foreman collects all time cards for the day, and also takes from his hook all work orders on which operations have been completed, but which are not yet ready to be turned in to the stockroom. He prepares a new time card for each man for the following day, assigns the next job by filling in the Work Order No. and the Opn. No., and places the card in the time-clock rack. In making his assignments, he looks over his shop copies of work orders and decides which jobs he wants done next. Then, if he does not find on his hook the travelers containing these jobs, he looks in the work-scheduled rack. Having found the proper travelers, he places the one assigned to each man on top of the others in that man's compartment, so that on the following morning, all the workman has to do is to punch in, go to the traveler rack, and get his assignment. If he works all day on the same job, he punches out and in before and after lunch, without further notation on the time card. At the end of the day he punches out, and, if he has not completed his operation, he replaces his traveler in his compartment.

Next day, unless the foreman has temporarily given him another assignment, he continues with the same job. Usually, however, he will complete two or more jobs during the same day. In such cases, he delivers the traveler to the stockroom, with the finished product, if the order is finished, or places it on the foreman's hook, if the order is not finished. He then punches out on that job, in on the next one, and goes to his traveler rack to get the top traveler. He marks the numbers of the work order and the operation on his card, and takes the traveler to the stockroom for materials and tools, after which he proceeds with the work. If the workman operates one machine tool only, he can tell from the machine number on the instruction card which operation is called for. If he can operate more than one machine, the foreman indicates the extra operations on a slip of paper, and inserts it in the traveler.

After the time cards have been collected, the foreman passes them on to the stenographer. She figures the elapsed time and the earnings on each work order listed, and posts the amount chargeable to each order on the back of the office copy, together with the employee's number and the date. The week may close on Thursday in order to allow Friday for the preparation of the payroll, which is made directly from the time cards.

At the same time, a distribution sheet of the labor used on each of the different classes of work orders is prepared. Productive work orders cover all labor used for the conversion of materials into salable product. Non-productive work orders include all general shop expense, repairs to shop equipment, experimental work, and all similar items. The labor for the week on each work order is added, the orders are classified by the accounts to which they are charged, and the weekly labor from each order is entered in the column to which the order is charged. A specimen labor-distribution sheet is shown in Fig. 13. This sheet is given to the bookkeeper and forms the basis for charges to the different accounts. It is obvious that the total of all charges appearing on this sheet must equal the shop payroll.

The part-record sheet, as its name implies, is used to record all necessary information about a specific part. The form is shown in Fig. 14. In addition to the printed headings, ample space is provided for entering any data that may be useful, such as the kind and quantity of material from which the part is made, and a complete record of any changes that

DAILY TIME CARD

THE TERRELL MACHINE COMPANY
CHARLOTTE, N. C.

Employee John Smith No. 4
Occupation Machinist Date 5-5-1929

WORK ORDER No.	OPN. No.	EARNINGS			ELAPSED TIME	CLOCK RECORD
1650	1	✓ 3	15	B	4.5	7.0
				S		11.5
1648	3	✓ 2	24	B	.5	11.5
				S		12.0
				B	2.7	1.0
				S		3.7
1654	2	✓	91	B	1.3	3.7
				S		5.0
				B		
				S		
				B		
				S		
	Totals	6	30		9.0	

Rate .70

Fig. 12—Daily time card. Spaces are provided for all entries. At the end of each day the foreman collects all time cards and makes out new ones for the jobs to be done on the following day

The second part of the article. The conclusion will appear in an early issue.

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have been made in the design, with reasons why they were made. The selling price is entered in pencil, as are likewise the cost items of labor, material, and total. These cost items are taken from the last completed work order and are revised when any changes in cost take place. Unit-cost figures are used. These unit-cost figures are later used in costing out shipping orders, which will be explained later. The selling price is used for invoicing, and the method of determining the proper price will be given later also. The code space is provided for recording the equipment shipped with each machine, and, as has been stated, an article describing this procedure appeared on page 843, Vol. 70, of the *American Machinist*. A standard, visible-index sheet, 5x8½ in., which is printed especially, is used. Assembly numbers are listed just the same as are individual parts, but in that case the form is stamped "See Assembly Sheet No. . . . ," such as Fig. 10 or 11. By arranging the part-record sheets by part numbers, and by using separate books for different machines, a very rapid method of pricing invoices and listing costs is provided. These books are also useful as drawing indexes.

LABOR DISTRIBUTION SHEET

WEEK ENDING MAY16, 1929.

Work Order No. or Account No.	Productive Labor	Non productive Labor	Non-productive material	Totals
1656	1.75			
1658	3.96			
1659	18.21			
1672	1.21			
1673	30.65			
1674	10.25			
1676	7.00			
1680	.55			
1682	12.45			
1683	4.28			
1685	5.35			
1686	2.56			
1687	19.10			
1690	45.50			
1692	2.10			
1693	.75			
1694	20.80			
Total Productive Labor	186.48			186.48
Shop Expenses:				
Misc. Shop Labor W.O. #1681		6.85	4.28	11.13
Shop Salaries		75.00		75.00
Experimental Expense:				
W.O. #1680		18.50	20.00	38.50
Selling Expense:				
Salaries		50.00		50.00
Administrative Expense:				
Salaries - Executive		75.00		75.00
Salaries - Office		50.00		50.00
		275.35	24.28	486.11
Book Entry:				
Debit - Mfg A/c - Labor	186.48			
Misc. Shop Labor	11.13			
Shop Salaries	75.00			
Experimental Expense	38.50			
Selling Salaries	50.00			
Executive Salaries	75.00			
Office Salaries	50.00			
	486.11			
Credit - Payroll Account		461.83		
- Mfg A/c - Material		24.28		
		486.11		

Note: Payroll Account is charged with all checks drawn for labor and salaries, and the bank is credited.

Payroll account is then credited, by the above entry, with the total labor and salary charges made to the proper expense and inventory accounts. When both charges and credits have been posted, the Payroll Account balances.

Fig. 13—Labor-distribution sheet. This sheet forms the basis for all charges to the various accounts. It is obvious that the total of all charges appearing on this sheet must equal the shop payroll

Formerly, a shipping-order form having four copies, an original, a duplicate, an acknowledgment, and a packing sheet was used. After the order had been shipped, a triplicate invoice was prepared. This method required writing most of the information in duplicate, and was a time-consuming job. Six-copy, continuous forms with interleaved carbon paper are now employed. The forms are as follows: Original, duplicate, and triplicate invoices, the original being shown in Fig. 15. The duplicate and triplicate invoices are the same as the original, except that they have the words duplicate and triplicate printed on them. The other three sheets are the shipping order, the packing sheet, and the acknowledgment. They are shown in Figs. 16, 17 and 18, respectively.

The entering and routing of these forms are handled in the following manner: The incoming order is first checked for accuracy and is priced, in pencil, from the part-record sheets. The invoice form is then placed in the typewriter, and the usual information is entered at the top. The invoice date is not entered until later, but all other entries are made. Then the proper entries are made in the columns under the heads Quantity Ordered, Part No., Description, or Name, and Price Each. These items copy on all three invoice forms, and all of the columns, except Price Each, copy on all forms. Only two of the carbons extend all the way across the sheets. Those making copies on the shipping order, packing sheet, and acknowledgment end at the line dividing the Description column from the Each column. Therefore, the Price Each is not copied on any of these three forms. The forms are now ready for distribution in the following order:

1. The three invoice copies are clipped together, with the carbons still between them, and are filed in the Incomplete Shipping Order file. They serve as duplicate shipping orders until shipment has been made, and the record of the order is therefore closed.

2. The shipping order and the packing sheet are clipped together with the carbon still between them, and are sent to the stockroom.

3. The date of shipment is entered in the space provided on the acknowledgment, which is mailed to the purchaser.

4. The next step is the filling of the order by the storekeeper. He enters the quantity shipped in the left-hand column of the shipping order, making a carbon on the packing sheet. He then has the shipment checked by the foreman, who signs both forms at the points indicated. The stockkeeper signs on the Filled By line on the packing sheet and places it in the package. He then returns the shipping order to the office for shipping documents, if they were not furnished with the order, and when they are sent to him he notes the date of shipment on the shipping order and returns it to the office. Usually it is well to have the shipping papers sent along with the ship-

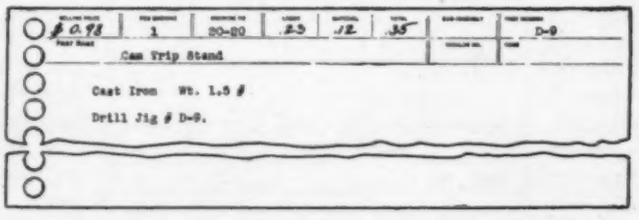
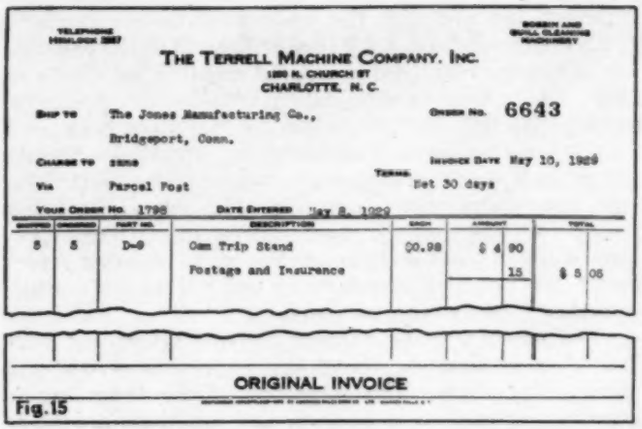


Fig. 14—The parts-record sheet. In addition to the printed headings, ample space is provided for entering any useful data, such as the kind and quantity of material used, and a record of any changes that may have been made in the design of the part



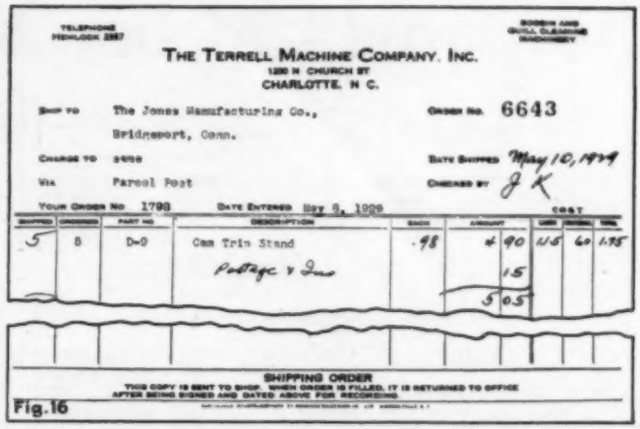
THE TERRELL MACHINE COMPANY, INC.
1200 N. CHURCH ST
CHARLOTTE, N. C.

Ship to: The Jones Manufacturing Co., Bridgeport, Conn.
Order No. 6643
Charge to: 5500
Via: Parcel Post
Terms: Net 30 days
Invoice Date: May 10, 1929
Your Order No. 1798 Date Entered: May 8, 1929

Shipped	Ordered	Part No.	Description	Each	Amount		Total
5	5	D-9	Cam Trip Stand	00.98	$ 4	90	
			Postage and Insurance			15	$ 5 05

ORIGINAL INVOICE

Fig. 15



THE TERRELL MACHINE COMPANY, INC.
1200 N CHURCH ST
CHARLOTTE, N C.

Ship to: The Jones Manufacturing Co., Bridgeport, Conn.
Order No. 6643
Charge to: 5500
Via: Parcel Post
Date Shipped: May 10, 1929
Checked by: J K
Your Order No. 1798 Date Entered: May 8, 1929

Shipped	Ordered	Part No.	Description	Each	Amount		Cost		
5	5	D-9	Cam Trip Stand	.98	4	90	1.15	60	1.75
			Postage & Ins			15			
					5	05			

SHIPPING ORDER
THIS COPY IS SENT TO SHOP WHEN ORDER IS FILLED. IT IS RETURNED TO OFFICE AFTER BEING SIGNED AND DATED ABOVE FOR RECORDING

Fig. 16

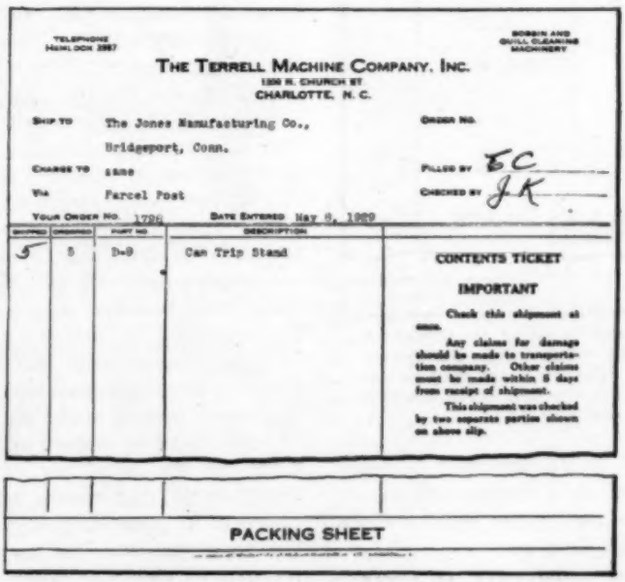
Fig. 15—The original invoice. The duplicate and the triplicate are the same as the original, except that they have the words duplicate and triplicate printed near their bottoms. Fig. 16—The shipping order. Certain copies from the invoices are made by carbon on the shipping order. The carbon sheets vary in width, so that some of the information on the invoices, and unnecessary on other sheets, does not appear on the shipping order

ping order, as it reduces handling and chances of mistakes.

5. The stenographer receives the shipping order, takes the invoices bearing the same number from the Incomplete Shipping Order file, and copies in pencil the Price Each on the shipping order. Then, multiplying the quantity actually shipped by the Price Each, she makes the necessary extensions in the Amount column of the shipping order. This column is then totaled. The invoice copies are replaced in the typewriter, the Invoice date is entered, and the Quantity Shipped and the Amount columns are filled in. Any shipment charges that have been prepaid are shown by a notation on the shipping order and are added to the invoice total, which is extended to the Total column. The original and duplictae invoices are then mailed to the purchaser, together with any necessary shipping documents, and the triplicate copy is given to the bookkeeper for entry.

6. The stenographer is now ready to cost out the shipping order. On the right are three columns: Labor, Material and Total. She takes the unit cost of each item from the part-record sheets, multiplies by the quantity shipped, and enters the proper amounts in pencil in the proper column. All three columns are then totaled, and the order is given to the bookkeeper. At the end of the month, before closing his books, he summarizes the totals from all orders shipped during the month on a cost of sales summary-sheet, Fig. 19, and uses the final totals as the basis of an entry, charging out the cost of all product sold.

It will readily be understood that machines can not well be entered part by part, and as the same forms are used for entering orders for machines as are used for entering orders for parts, some provision must be made to care for them. Every three months a material list covering every part used on a machine is prepared, using the latest unit costs shown on the part-record sheets. The total cost, thus arrived at, is used for the ensuing three months. These material lists are kept in the back of the parts-record sheet books, where they are readily available. Standard assemblies that are furnished on all machines are listed in one group, while those subject to variations are listed separately. On the back of each shipping order there is a code form that gives complete information as to what assemblies were furnished on the machine covered by the order. This code is filled in by the foreman when shipment is made, and is used for determining what assemblies shall be costed out, and later for record purposes. Thus, from the material lists, the cost of a machine can be quickly figured and entered on the shipping order. The raw materials originally purchased have now been converted into finished product, sold, and invoiced. The bookkeeping end of the problem may now be taken up.



THE TERRELL MACHINE COMPANY, INC.
1200 N. CHURCH ST
CHARLOTTE, N. C.

Ship to: The Jones Manufacturing Co., Bridgeport, Conn.
Order No.
Charge to: 5500
Via: Parcel Post
Filled by: E C
Checked by: J K
Your Order No. 1798 Date Entered: May 8, 1929

Shipped	Ordered	Part No.	Description
5	5	D-9	Cam Trip Stand

CONTENTS TICKET

IMPORTANT

Check this shipment at once.

Any claims for damage should be made to transportation company. Other claims must be made within 5 days from receipt of shipment.

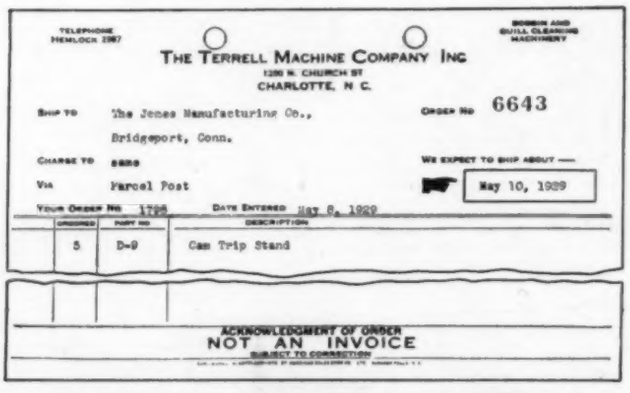
This shipment was checked by two separate parties shown on above slip.

PACKING SHEET

Fig. 17—The packing sheet. With a carbon sheet between them, the shipping order and the packing sheet are clipped together and are sent to the stockroom, where the date of shipment is entered

Before analyzing the different accounts, it may be well to state that the system of bookkeeping used is satisfactory either for pen and ink, or for a bookkeeping machine. Both have been used with equal success. The machine method gives quicker balances and permits more minute subdivision of expense accounts than is practical with pen and ink. This does not affect the accuracy of the results in the long run, but it does give better control over expenditure. It is for that reason that the machine method is now being used. Balance sheets and profit and loss statements can be prepared very rapidly by either method, and trial balances are eliminated.

It has been found easier



THE TERRELL MACHINE COMPANY INC
1200 N. CHURCH ST
CHARLOTTE, N. C.

BOBBIN AND QUILL CLEANING MACHINERY

SHIP TO: The Jones Manufacturing Co.,
Bridgeport, Conn.

ORDER NO 6643

CHARGE TO 6880

WE EXPECT TO SHIP ABOUT — May 10, 1929

VIA Parcel Post

YOUR ORDER NO. 1795 DATE ENTERED May 8, 1929

ORDERED	PART NO	DESCRIPTION
5	D-9	Cam Trip Stand

ACKNOWLEDGMENT OF ORDER
NOT AN INVOICE
SUBJECT TO CORRECTION

Fig. 18—The acknowledgment, used to acknowledge the receipt of the order. It contains all necessary information, including the expected date of shipment

to work from the balance sheet back to the original entry, rather than to take many separate entries and show their relation to the whole. Starting with the balance sheet and the profit and loss statement, the principles of control become quite clear, and the details of entries will be equally clear to anyone having a working knowledge of

COST OF SALES SUMMARY SHEET
MONTH OF MAY, 1929.

Shipping Order Number	Labor	Material
1267	$ 4.85	$ 6.21
1268	2.12	1.80
1269	8.30	7.22
1270	1.75	2.12
1272	14.28	20.50
1273	1.25	.75
1275	3.20	5.75
1276	5.35	4.00
1277	.28	.45
1280	40.50	10.75
1281	1.15	.80
1282	.70	1.25
1284	.50	1.75
1286	11.30	7.90
1287	4.60	9.35
1290	2.55	4.80
Totals	(A)$102.68	(B)$85.40

Book Entries Required:

(A) Dr. Cost of Sales A/c - Labor
Cr. Mfg. A/c - Labor

(B) Dr. Cost of Sales A/c - Material
Cr. Mfg. A/c - Material

Fig. 19—Summary sheet of the cost of sales. On this sheet the bookkeeper summarizes the totals from all orders shipped during the month. The final totals are used as the basis of an entry for charging out the cost of all product that has been sold during the period covered

bookkeeping. As this article is not intended to teach bookkeeping, the details of ordinary entries will not be discussed. However, before taking up the balance sheet, the details of three accounts will be given.

The manufacturing account (material) is charged with all material inventories and with materials purchased for conversion into finished product. It is credited with the cost of all materials sold in the form of finished product, but not with the labor used in manufacture. This credit consists of the totals of the Material columns on shipping orders and is entered monthly, as shown in Fig. 19. Other credits, taken from work orders on which materials charged to the account have been used for other than productive purposes, are made directly from such work orders when they are summarized on the labor-distribution sheet, Fig. 13. Allowance being made for waste on the work orders, the difference between the charges and the credits to the account represents the material inventory at the end of the period, whether it be monthly or yearly.

The manufacturing account (labor) is charged with all labor used in the conversion of raw materials into finished product. The inventory at the beginning is carried forward as a balance, and additions are made weekly from the labor distribution sheet. The account is credited with the totals of the Labor columns on the shipping order, and represent the labor cost of product that has been sold during the month, as Fig. 19 shows. The balance of the account, after all postings have been made, represents the labor cost of products remaining in stock.

The Cost of Sales account is divided into two sections: Labor and Material, the same as the manufacturing account. It is charged with the totals of the Labor and Material columns on the shipping orders. The entry is made monthly, and it will be noted that it consists of exactly the same items as are credited to the manufacturing account, labor and material, excepting such items as are credited to the material account from non-productive work orders. [*The first article of this series appeared on page 649, Vol. 71.—Editor.*]

Personnel and Production—*Discussion*

By Harry Kaufman

THE editorial under the above title, on page 908, Vol. 70, of the *American Machinist*, is timely. Employment in modern industry is a specialized service, requiring both intensive training and natural aptitude. Careful selection of the employment manager is a primary duty of the management in connection with labor maintenance. The employment official should be grounded thoroughly in the principles and practices relating to his own work, and in addition, he should have a general knowledge of approved methods in the entire industrial relations field.

The personnel director, or employment manager, in giving the prospective employee an interview, should endeavor to determine whether the applicant is suitable for employment for any specific type of work. Something must be learned as to the applicant's skill, training and aptitudes, in order to put him in line for promotion. It is also important to secure information about his moral and intellectual background, former environment and views toward social and industrial institutions.

Attainment of these purposes is of the highest importance to the employer. No argument is needed to demonstrate the inanity of entrusting the interviewing function to some languid youth, who reads a list of perfunctory questions to an applicant in full view of a roomful of clerks or other applicants, and fills in routine answers. Great care must be taken in selection of the interviewer and in planning his work, if the employment department is to serve the plant to the best advantage.

Turning Crankpins in Place

By Chester H. Franklin

TURNING crankpins in place has long been one of the problems of the locomotive repair shop, and various mechanisms have been devised for the purpose. In too many cases the devices used involved an overhanging arm carrying a tool at its outer end. This combination invariably means undue vibration, making a good surface on the turned pin almost impossible.

The substantial crankpin turning device shown in Fig. 1 was designed by engineers of the Santa Fe system, and is in use in many of its shops. It consists of a large base that is bolted against the face of the driving wheel at three points. Three heavy beams of channel section connect the front end to the base, and form a sort of cage. Inside this cage is a large bearing plate at each end, these plates being connected by two beams that carry the turning tools and permit the toolblocks to slide lengthwise of the crankpin under control of the feed, which is on the "star feed" order.

As can be seen, the toolblocks are well supported on slides in the revolving inner portion of the device. The tools are of the regular lathe-tool type.

The inner, or tool-carrying, part of the machine, is driven by gearing on the outer diameter of the end next to the driving wheel. Power from an air motor is transmitted either through the universal joint shown in Fig. 1 or by spur gears as in Fig. 2. The outer end of the machine is located by a center, as shown at *A*, Fig. 2, but is hidden in Fig. 1. The crossbar carrying the center can be adjusted for crankpins of different lengths. Center screw *B* fixes the throw of the crankpin from the center of the axle.

Feed is secured by the stops at the outer end of the machine. These are in the stationary part, or frame, and act as dogs for star wheels on the feed screws.

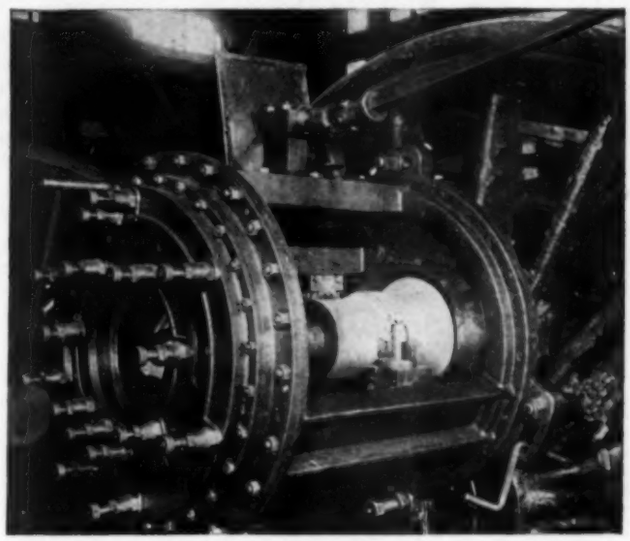


Fig. 1—Purcell crankpin turning machine as used on the Santa Fe

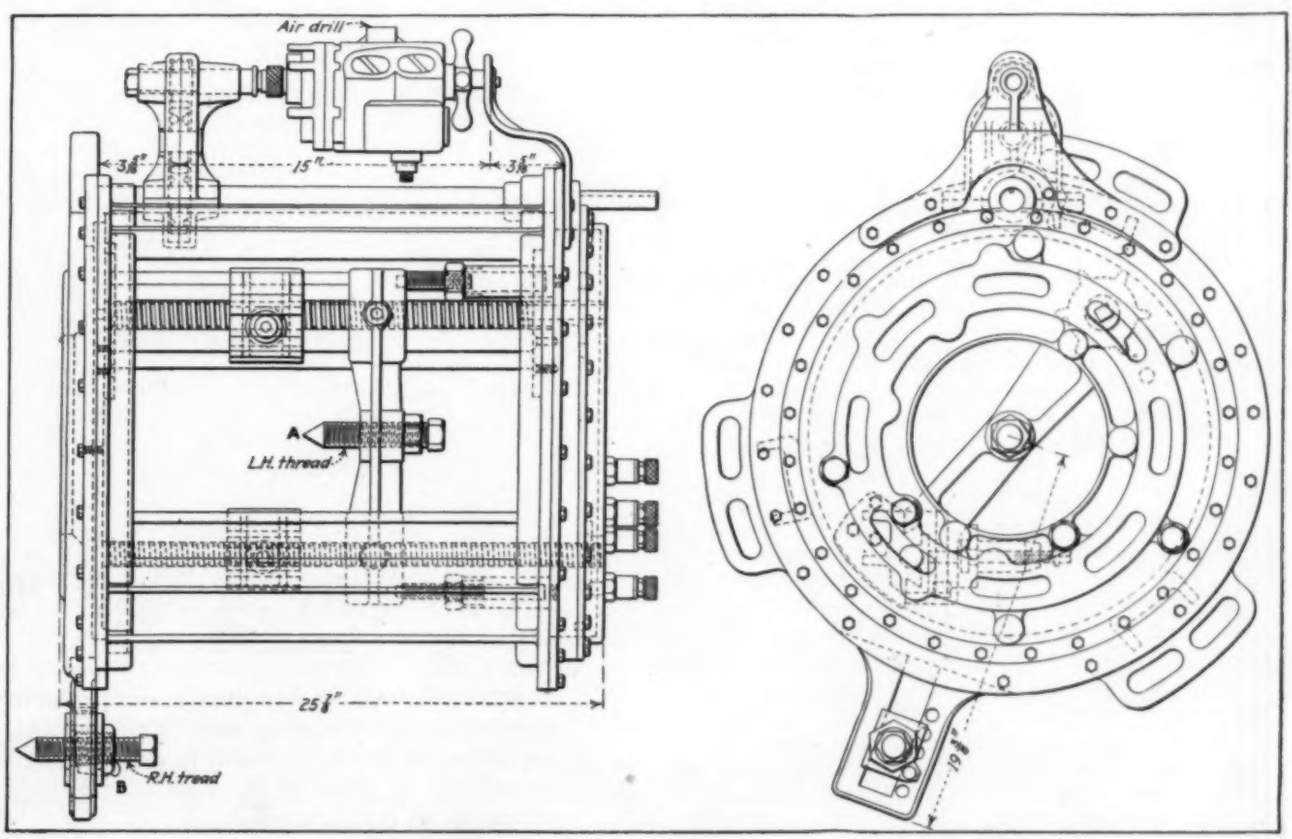


Fig. 2—Assembly details showing location of the center and feed screws

EXECUTIVE · FORUM

Upsetting Production Schedules

"HELLO, Bill. Sit down here a few minutes, will you? I want some advice." William Holland glanced through the car window to see where they were, and then dropped into the lounge car chair beside Joseph Wood, president of a big manufacturing corporation in a nearby city.

"All right, Joe, but it will have to be brief. I'm getting off at the next stop. We have about twenty minutes. What is it?"

"It's a personnel problem, Bill. After all the time our works manager has been with us, he has just begun to get hard to handle."

"Oh," said Holland. "Perhaps you're driving him too hard. I hear you're pretty busy."

"Yes, we are. But I don't think it's that. He never raised any objection over high-pressure operation before. Always seemed to like it, in fact."

"Well, I've had my guess. What's yours?"

"It's something to do with this new steel we're putting on the market, I think. I've been pushing it myself, and getting samples into the hands of important customers as fast as I could. And it's been annoying to see how slow the shop is in filling orders."

"I suppose it is annoying to a high-power salesman like you, Joe, not to be able to deliver day before yesterday to a good prospect you've just got all steamed up over your goods, but remember the production man's side of it. You're president now, and not sales manager, and you'll have to handle both sides of the job."

"Never mind the sermon, Bill. I think I know what's going on in my own company."

"All right, don't get excited. But I'll just bet you a good hat I can guess what's ailing your production manager, and that you don't know as much as you think you do about that shop."

"You're on. What is it?"

"Well, if I interpret correctly what you just said, you yourself are upsetting the production schedule by demanding priority, preferred treatment, for some of these people you're so anxious to impress. You have a new product, and a good one, from what I hear. And unless your production men are very different from others I've known they are having their own troubles in getting organized to fill orders for it."

"Why should they have trouble?" objected Wood. "Haven't they been in the game long enough to know what's required to get work under way? They had enough warning about what was coming. We didn't get into this new line overnight, you know, Bill."

"That's all right. I realize how you tried to anticipate your trouble, Joe, but a lot of things come up in production that aren't uncovered in the experimental stage, and you can't blame the shop for such difficulties.

"To make matters worse, you rush in and tell them to forget all those prior orders they are breaking their necks to fill, and put all hands to getting out a special for somebody you've just been talking to."

"But, Bill, you have to 'ride' the shop in most cases to get the production crowd to realize that there's such a thing as red-hot competition in business, and for some customers it's 'full speed ahead' before somebody else hooks the orders."

"Now, wait a minute, I'm not going to argue with you," replied Holland to Wood's interruption. "I've got to get off this train in a minute. The engineer just shut off. I'm telling you that I never saw a plant yet where they could have somebody at the top upsetting schedules without ruining dispositions and reducing the output. In some things the shop must be left alone.

"I know this is a one-sided argument, but you just look into the thing from the angle I've just suggested. Then I'll let you buy me that hat. This may be a personnel problem, but not the kind you think it is. I'll be back next week. You can buy me the hat then. Good-by."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

DISCUSSION

Interesting Men in the Job

Quantity and quality of work improve appreciably when workers are keenly interested in what they are doing. Once the zest that characterizes a man when pursuing some pet hobby takes possession of his everyday work, then he becomes a more valuable asset both to himself and to his employer.

The great problem is not how to get a man to do good work, but how to get him sufficiently interested in the job, so that he will want to do good work. His interest can be effectively aroused if he is enabled to see for himself something of how his "bit" dovetails into the work of other men, and to what extent his own part is essential to the whole. If men are given an insight into the principles underlying efficient production, how costs are kept, and something about the economics of manufacturing, they are led to look upon their jobs in a higher light and to take an attitude of greater responsibility in performing their work.

The wide-awake employer is on the alert to provide the means whereby his office and shops employees may acquire an outlook of this scope and usefulness. One effective expedient when a new employee is engaged, especially for a position of relative responsibility, is to have some well-informed man show him through the plant and explain how manufacturing operations are carried on. This plan is followed by many firms in England when a designer or draftsman, for instance, is introduced to his staff appointment.

—W. R. NEEDHAM, *Engineer, Design Dept. English Electric Company, Ltd.*

Does a Highly Developed System Pay?

An inflexible system which permits of no deviation and eliminates all initiative is probably worse than no system at all. An example of such a system was given in a large plant a few years ago. A draftsman who had occasion to go to the basement of the office building discovered that a water pipe had burst and was rapidly flooding the place. He immediately reported the matter to the chief draftsman who, in turn, wrote a letter to the chief engineer. The chief engineer wrote to the superintendent of building, who made out the proper form calling for a repair, and sent it to the general manager for approval. By the time the order had passed through the prescribed routine and finally reached a workman who shut off the water, the basement was flooded to a depth of about two feet, and considerable damage was done.

Those who were chafing under the excess of system pointed out to the president that, had the draftsman been permitted to telephone immediately to the maintenance foreman, the water could have been shut off before any damage was done. But the president, unfortunately, refused to permit any deviation from the system. About a year and a half later the concern went through a receivership. The new owners are running it with less system and are making good profits.

—C. J. MORRISON.

Friendliness in Business

Friendliness in business is a result, not a cause, of business relationship. Extreme friendliness extended on an initial business contact may well be viewed with alarm, but that resultant from long satisfactory business relationship is but a natural expression of confidence and good will. No organization is going to jeopardize business contacts of long standing by capitalizing friendship to the other organization's disadvantage on a single transaction.

Real business organizations prize their friendly relationships, and would be the last in the world to suffer their loss for a momentary advantage. In fact, experience has shown that a friendly organization is always given the "breaks" by a reputable seller, for he would be the last one to have the sincerity of his friendship questioned by any transaction. To maintain these relationships is an investment in trouble insurance, and the concern that would deliberately forego them is signing its own eventual death warrant.

—JOHN F. HARDECKER,
Chief Draftsman, Naval Aircraft Factory, U. S. Navy Yard, Philadelphia.

What is Modernization?

Modernization in the metal-working plant means the introduction of improvements in machinery, tools, methods, and designs to cut the costs and increase the quality of the products manufactured. The design of the product is the starting point for a program of modernization. Simplification and improvements often not only cut costs but may also increase the sale of products. Methods of machining and assembling should be changed where it is possible to speed up the work or improve its quality. Machines and tools should be redesigned and rebuilt, or replaced, to give the highest production that is economical with the quantity and quality of product that can be sold.

The plant layout should be changed to eliminate as nearly as possible all handling, backtracking, or temporary storage of parts in process. Inventories should be kept sufficiently low to prevent the tying up of a large amount of money but still be large enough to take advantage of the economies of mass production. Buildings should be put in first-class condition to house the equipment and facilitate plant operation.

All of these improvements require the expenditure of money, but each step in modernization can be made to reduce manufacturing costs, bring about large savings, and enable the company to pay higher dividends.

—L. O. BROWN, *Toolroom Foreman, Holcomb & Hoke Manufacturing Company.*

· BOOK · REVIEWS ·

SOCIAL ASPECTS OF INDUSTRY. *By S. Howard Patterson, professor of economics, Wharton School, University of Pennylvania. Five hundred thirty-nine pages, 6x9 in. Cloth board covers. Published by the McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York, N. Y. Price $3.*

THE author of this book has written several previous books on social-labor problems, and has a good background for the present volume. It is a thorough textbook on a subject on which there is a wide divergence of opinion, and he treats each side with a notable fairness.

In treating his subject the author recognizes three approaches to the solution of the social problems of industry, namely through state legislation, through collective bargaining of organized labor, and through liberality and good judgment on the part of the employer. It can be judged from the text that he favors the latter method, but sees the justice of many of the steps of organized labor when the humane tendencies of employers fail. The book covers, in general: the social and industrial background of labor problems, human conservation and labor legislation, collective bargaining and labor organizations, and scientific labor management and personnel administration. It details much worth-while information on labor laws, the short day, human safety, family wages, industrial conflicts, employee representation and profit sharing.

*

THE ART OF RAPID READING. *By Walter B. Pitkin. Two hundred and thirty-three pages, 5¼x8 in. Published by McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York, N. Y. Price $2.50.*

WRITTEN particularly for the business or professional man who has little time to spare for reading, this book outlines a method of reading, gives a schedule, and includes a number of exercises calculated to develop ability in rapid reading. The author, a professor of journalism at Columbia, applies editorial methods of reading and skimming to everyday reading. The book is essentially a handbook to be used for exercises, and as such is unusually complete. To anyone required to read anything from newspapers to technical reports quickly, yet carefully, this volume is of particular interest.

*

MACHINE SHOP UNIT, PART II. *Edited by H. C. Thayer. Twelve sheets, illustrated, 8½x11 in., paper cover. Published by McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York, N. Y. Price 35 cents.*

THIS booklet contains twelve instruction and process sheets dealing with machine shop operations. They have been prepared by several instructors in the City Vocational Schools of Wisconsin as an aid to class instruction. The information and instructions are both abstracts from "Machine Tool Operation" by Henry D. Burghardt, (McGraw-Hill Book Company, Inc.).

The subject matter in the process sheets is arranged uniformly and is confined to instructions and the briefest of notes. Where extended information is necessary, an instruction sheet supplements the process sheet. Twelve subjects covered in Part II include: The use of a hack saw, filing, drilling, aligning lathe centers, grinding tool-bits, thread cutting, and milling operations.

Several review questions are given at the bottom of each process sheet.

*

AERIAL NAVIGATION AND METEOROLOGY. *By Capt. Lewis A. Yancey. Three hundred sixteen pages, 6x9 in. Published by Norman W. Henley Publishing Company, New York. Price $4.*

THIS is the second edition and has been much enlarged. The author has an excellent reputation as a navigator, both at sea and in the air, his flight to Rome being his latest achievement in this line. There are eleven chapters and an appendix, dealing with the problems of bearings, directions, compass courses, compass errors, and corrections, all being of vital importance in air navigation. Examples are given, instruments are shown, and much useful information concerning their use will be found. Meteorology also receives attention.

*

COMMERCIAL AND INDUSTRIAL ORGANIZATIONS OF THE UNITED STATES. *Revised Edition, 1928. Compiled under the direction of John A. Smith, Domestic Commerce Division, U. S. Bureau of Commerce. Two hundred seventy-two pages. Cloth board covers. Published by the United States Government Printing Office, Washington, D. C. Price 60 cents.*

THE aim in preparing this seventh edition of Commercial and Industrial Organizations of the United States has been to include all such organizations as have for their purpose the advancement of an industry generally on a regional basis, that is, local, state, or territorial. This naturally excludes organizations which are primarily for social purposes. Alphabetical and classified lists are given for the national, international, and interstate organizations, while state and territorial ones are listed by states and territories and local organizations are listed by state and city. The book should be of value to anyone interested in organizations of this sort, since secretaries' names and addresses and other pertinent information are given.

*

THE OXY-ACETYLENE WELDER'S HANDBOOK. *By M. S. Hendricks. Two hundred eight pages, 4½x6½ in. Published by The Acetylene Journal Publishing Company, Chicago, Ill. Price $3.*

ALTHOUGH oxy-acetylene welding can no longer be considered as new, much of the technique has been developed within the past five years, particularly the welding of different metals. The ten chapters of the book, which is of convenient size for the pocket, deal with the gasses used, the equipment and the way in which it is set up for use, the preparations necessary for good welding, the methods used in handling different kinds of welds and in inspecting them after they are made, the training of operators, welding properties of common metals, and various tests and applications with which every welder should be familiar. The little volume contains much practical information about various metals that every welder should know and without which he can hardly qualify as a reliable operator.

Metal Work in Building Airplanes

Specialization in equipment, and refinement of the processes used, are changing the building of airplanes from unit to quantity production

By R. E. JOHNSTONE

Engineer, Boeing Airplane Company

TWENTY-FIVE years ago the Wright brothers constructed a flying machine of wood and linen, and with it accomplished the first sustained flight ever made by man in a powered aircraft. Since the birth of aviation, experimenting engineers have striven to develop safety in air travel, as well as to cultivate its potential speed. Today safety and regularity are elemental characteristics of air transportation as a result of the tireless efforts of aeronautical engineers. American business is adopting air travel at its full worth as an indispensable means of communication and transit, and the airplane has become an integral part of the great scheme of national and international transportation.

During the 25-year period of development and improvement in the airplane, metal has steadily gained prestige as a leading material in aircraft construction, until today the all-metal plane is not unusual. Wood and other materials are slowly but surely being replaced by more efficient and satisfactory material in the major portions of the structure.

Aircraft manufacture is becoming an important factor among the industries of America. The Boeing Airplane Company at Seattle is the largest plant in the country given over entirely to the production of aircraft. Military planes, mail planes, mail-passenger-express planes, seaplanes, "sport" planes, training planes and tri-motored transports are among the forty-five different models of airplanes designed and constructed by this organization. As the trend toward increased usage of metal in airplane construction has developed, there has been a proportionate increase in the importance of the metal shops of the Boeing plant, and this section of the manufacturing organization is now the largest.

A large portion of the plant is given over completely to the metal working departments, which include the machine shops, the welding and brazing department, the sheet metal section, and the other divisions of the metal unit. On the speed and the efficiency of the workmen of this unit depends to a great extent the progress of airplane production at the plant.

The fuselage of the airplane is assembled in the welding and brazing department after the various parts have been manufactured in the machine shop and other sections of the metal unit. The first step in the fuselage construction is the designing, after which specifications for parts are transmitted to the machine shop. This department, a corner of which is seen in Fig. 1, includes a force of more than two hundred expert machinists, who, working with modern mechanical facilities, produce not only the parts required for aircraft construction, but also the majority of the tools used by other departments.

Besides the usual batteries of engine and turret lathes, grinding, milling and nibbling machines, and presses, there are several special machines of the company's own design and construction. Particularly interesting and important is a 42-ft. draw bench shown in Fig. 2. By means of this equipment, the company is enabled to draw square, rectangular, and stream-lined tubing for framework construction.

Two requirements for aircraft construction materials were behind the development of this special draw bench,

Fig. 1—A section of the lathe and shaper department in the plant of the Boeing Airplane Company, Seattle factory. The shop contains many specially designed machines

Fig. 2—Drawing stream-line tubing of square, rectangular and stream-line shapes as well as channel sections and similar parts

and both were necessary to the success of aircraft production. They are maximum strength with minimum weight, and stream-line effect for the parts exposed to the air stream. Steel-alloy and aluminum-alloy tubing drawn to desired shapes fulfills these requirements, making this especially designed draw bench an important production feature of the machine shop.

The main feature of the draw bench is its heavy endless chain, traveling around large sprockets at either end. There is a carriage on top of the bench with a hook attachment which can be secured to the chain, and also a lock that grips the tubing to be drawn. The chain moves at a speed of 15 ft. per minute.

Preparatory to the drawing process, the round stock tubing is annealed in the electric heating furnaces. It is then sent to the draw bench in the machine shop. The die plugs used for drawing are variously designed to conform to the desired shape of the tubing—square, rectangular, or stream-line, and are affixed to the ends of long steel rods. The die rod is inserted through the tubing and secured to a stationary clamp at the end of the bench. The tubing is then locked to the carriage, which in turn is attached to the moving chain. The power of the chain literally draws the tubing over the die plug into the desired shape.

The sheet-metal department is equipped with heavy hydraulic presses, rollers, shears, and punching presses to produce tanks, cowlings, radiators, metal surfaces, seats, and many other such parts.

There is, necessarily, a great deal of pressing and forming of metal in the sheet-metal department, where cowling, tail surfaces, seats and flooring, gasoline tanks, and similar parts are produced. The biggest factor in the production of these parts is the 700-ton hydraulic press, with an auxiliary press of the same type, but with a capacity of only 40 tons. The hydraulic press, Fig. 3, is powered by pressure from city water, of slightly more than 100 lb., augmented by additional pressure supplied by an electric pump. The platen of the large press is 120x160 in. On one job it cut the time from 32 hours of hand work to 2 minutes by the machine. The tail surfaces, or empennage, of the airplane, which are for control and balance when in flight, are pressed for corrugation and stream lining. The corrugation of the surface is for the stiffening of the part, as Fig. 4 shows.

The sheet metal is formed in wooden dies produced in the plant's woodworking department. Hard maple is used for die construction, and the dies are so made that they conform strictly to specifications, and are perfectly aligned. They are then surfaced with wax, so that the metal will assume the desired shape readily under pressure. Next they are sent to the sheet-metal department, where the metal to be formed has been cut to the shape of the pattern. The upper die is usually fastened to the under side of the top head of the press, and the lower die is secured to the platen. The metal is laid on the lower die, and pressure is applied. When the maximum of city water power has been reached, the operator of the press starts the electric pump by remote control, thus furnishing additional pressure sufficient to complete the pressing operation.

Duralumin, Alclad, and aluminum are the metals chiefly formed in this way. All are used in the production of empennage surfaces, gasoline tanks, ailerons, cowling. seats, flooring, and similar metal surfaces. Brass and copper are used to some extent for small tanks and other parts, and steel is formed for exhaust rings.

The large press can accommodate metal ranging in

Fig. 3—The 700-ton hydraulic press used to form stabilizer covers, wing and tail surfaces, seats, flooring and many other sheet metal parts of airplanes

thickness from 0.01 to $\frac{1}{8}$ in. When the metal is fairly thick, the wooden die is reinforced with metal. In the case of formed steel work, cast-steel dies are prepared and used in place of wooden dies.

When the specified order has been filled, the tubing and other parts are cleaned thoroughly, and cut into desired lengths. A "mock-up" plane—a sort of pattern—is constructed in a steel jig, which has been carefully assembled on a permanent level base of steel. The mock-up is well-tested, and templets are made of the jointed tubings. Then the material is cut to coincide with the required measurements and fuselage assembly commences.

When the fuselage framework has been constructed, the joints are electrically welded by workmen especially trained for the work. In structural work all parts are electrically welded, although torch welding and brazing are used in other types of aircraft work. A typical welded joint is seen in Fig. 5. The welder handles tubing

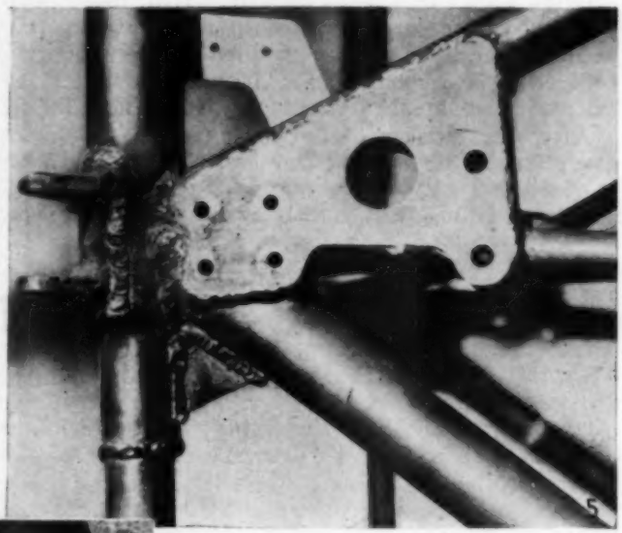


Fig. 5—A front wing and landing gear attachment which has been electrically welded in the welding department

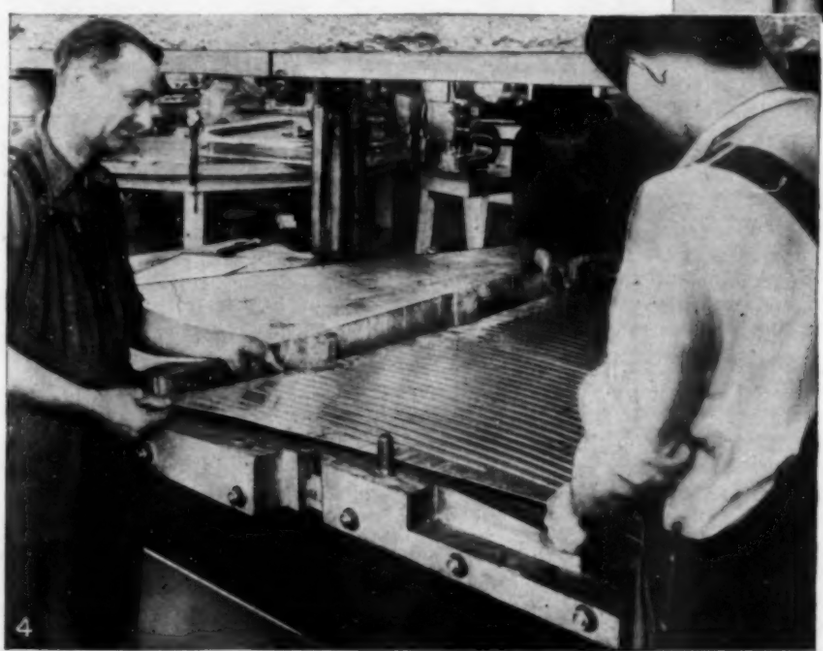


Fig. 4—Removing a completed stabilizer cover from the wooden die on the platen of the 700-ton hydraulic press in the sheet metal department

of varying diameter, and from 0.035 to 0.075 in. thick.

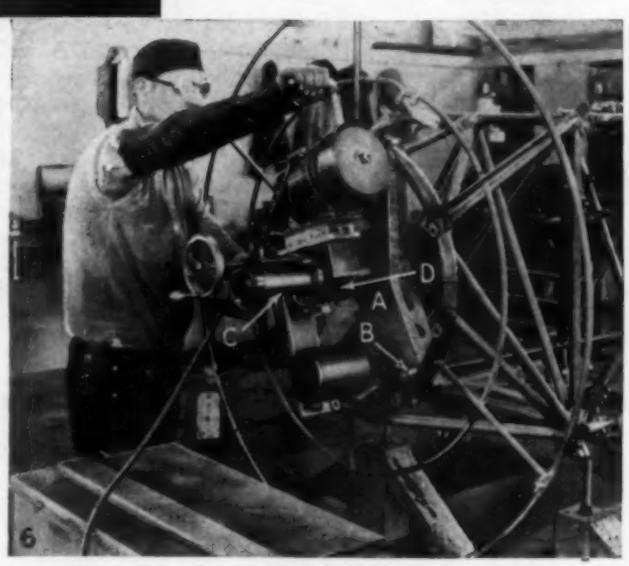
When all joints have been welded, the fuselage is taken out of the jig and the welded parts are cleaned. The framework is then thoroughly oiled inside with a 10-lb. air pressure oiler, which forces the oil into recesses of the fuselage. Porous welds are located by this treatment, and are immediately repaired.

The company employs 326 men in the welding and brazing department. The company endeavors to hire none but the most experienced welders for both electric and torch welding. However, with the development of electric welding and its peculiar application to airplane construction, it has been necessary to conduct courses in aircraft welding for all welders.

This course includes practice work to give the welders the touch requisite to the handling of the thinner gauges of metals used in the production of airplanes. After the completion of this course, the welder is thoroughly tested, with a requirement of a maximum failure being set. The training methods for electric welding are quite similar to those for torch welding, but inasmuch as aluminum welding is a highly specialized form of torch welding, a special training is required.

The courses of instruction are under the supervision of a leading welder, who is expert in both electric and torch welding. He is also in charge of

Fig. 6—After the fuselage has been assembled each boss on the engine base is ground to a perfect plane



actual production, and thus is continually observing and examining all welding operations. He assigns the various welding jobs to the workmen in accordance with their abilities, with which he is familiar. With that system, the best welders are delegated to the most important welding operations. Close attention to this practice is believed to be responsible for the very satisfactory results obtained by the system of welding now in use.

After the fuselage of a Boeing plane is completely assembled in the welding and brazing department the bosses on the engine base or mounting ring are ground with a special machine, as in Fig. 6. This grinder is one of the special tools designed to facilitate the work and make it easy to obtain good mounting surface for the radial engine.

The grinding machine consists of a substantial three-cornered base *A* which is located by guide pins *B* that bear inside the mounting ring and is clamped to it. The base carries a central shaft *C* on which is mounted a portable electric grinder that can be rotated on *C* so as to reach each of the nine bolt bosses. The grinder is mounted on a sleeve *D* by which it can be fed into the work as desired and yet be turned freely from one bolt boss to the next.

Two Methods of Calculating Depreciation

By F. Trevor Daniel

Chief of Planning Department, Standard Telephone and Cables, Sydney, Australia

IT HAS been suggested that it is more rational to calculate annual, or other, depreciation of plant items on their replacement cost than on actual cost, and examples of such methods have been shown. It is claimed that this method enables truer competitive cost comparisons to be made and at the same time provides for the time-effect of varying market prices for machinery and plant.

Designating this proposal as method *A*, it appears, however, to have some disadvantages such as:

1. It differs from the taxation authorities' allowable depreciation rates.
2. Actual purchase cost is the real accounting concern of any machine, irrespective of what will happen when a new one is needed, or what machines competitors have.
3. It incurs a fluctuating depreciation rate dependent on the vagaries of the outside market, which have not necessarily any relation to affairs in the shop concerned.
4. By this method an item could apparently be depreciated more than its full book cost during its useful life, which appears somewhat peculiar and inconsistent.
5. Most important of all, as shown in the table, the total of accumulating depreciation plus depreciated value does not equal replacement cost at the end, or at any period of the machine's pre-estimated life period. Thus, the decision to scrap a machine due to obsolescence involves facing a loss on replacement.

A different suggestion, designated as method *B* will avoid some of the disadvantages mentioned, and yet take account of the variation of market prices of plant or machine tool items. This method is as follows: (a) Set aside the standard annual depreciation on the item, (b) transfer all expense out of gross profit into replacement, or obsolescence reserve, the difference between the present cost and last year's cost on the market. This becomes an accumulating amount capable of financing at any time the difference between replacement cost and actual cost. Together, these items cover the difference between replacement and book value at any time.

It will be noted that method *B* allows:

1. Concurrences with the rate allowed by the taxation authorities.
2. The part logically due to actual expenditure, as well as an exact value for competitive comparison.
3. The choice of either standard depreciation rate or actual effective depreciation rate.
4. The replacement, or obsolescence, reserve to be correct at all times.

The accompanying simple, hypothetical table illustrates the principle and compares *A* and *B* on a machine costing 100 units, having an estimated life of, say, ten years, which agree with the shortest taxation period allowed, and a haphazardly-chosen increasing market cost over the 10 years. It can be seen that, at any period under method *B*, the accumulated depreciation plus accumulated reserve, totalled in column 8, and added to depreciated value of the machine in column 9, always equals replacement cost, column 2, which is the desired end. Under method *A* there is no corresponding equality, shown by the 127.5 total depreciation at the end of the period when it is required to purchase a new machine at 150 units.

A reduction in market cost is followed with *equal* facility in method *B* by noting the changed replacement value as a negative figure in column 6, thus reducing the amount in column 7. In this manner at any time from purchase date onwards, the finances for that machine are a true reflex of its age and the outside market conditions. Column 8, under method *B*, does what column 4, under method *A*, is intended to do. The extra clerical work is very slight, and the method can be applied separately to each machine, or to the whole department.

Comparison of Depreciation Methods

1	2	3	4	5	6	7	8	9
		—Method A—			—— Method B——			
Years from Purchase	Replacement Cost	Annual Depreciation	Accumulating Total	Normal 10% Accumulating Depreciation	Annual Cost Difference	Accumulating Cost Difference	Total Columns 5+7	Deprec. Value
0	100	....	.....	0	....	....	....	100
1	105	10.5	10.5	10	+ 5	+ 5	15	90
2	110	11.0	21.5	20	+ 5	+10	30	80
3	110	11.0	32.5	30	....	+10	40	70
4	120	12.0	44.5	40	+10	+20	60	60
5	130	13.0	57.5	50	+10	+30	80	50
6	130	13.0	70.5	60	....	+30	90	40
7	135	13.5	84.0	70	+ 5	+35	105	30
8	140	14.0	98.0	80	+ 5	+40	120	20
9	145	14.5	112.5	90	+ 5	+45	135	10
10	150	15.0	127.5	100	+ 5	+50	150	0

Heat-Treating in a Western Shop

Fig. 1—Typical parts for hydraulic rotary drilling machines, which require heat-treatment. Each part receives a treatment suited to its individual needs

Fig. 2—Coating the threads liberally with moistened boric acid decreases oxidation during the hardening process, and thus preserves the sharpness of the threads

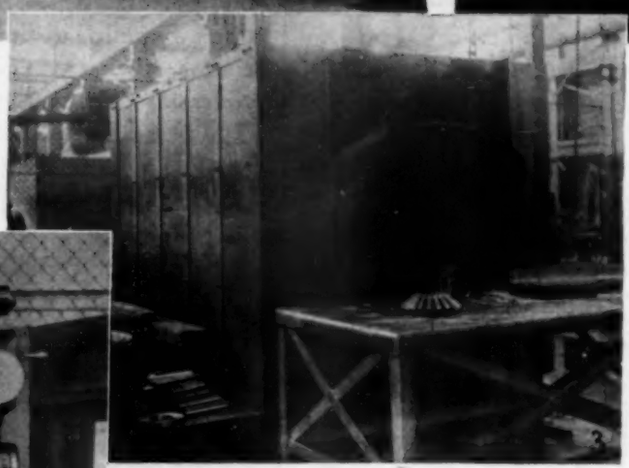


Fig. 3—An electric furnace is used for both hardening and carburizing. The parts are preheated at a comparatively low temperature before being brought up to the specified hardening temperature in the same furnace

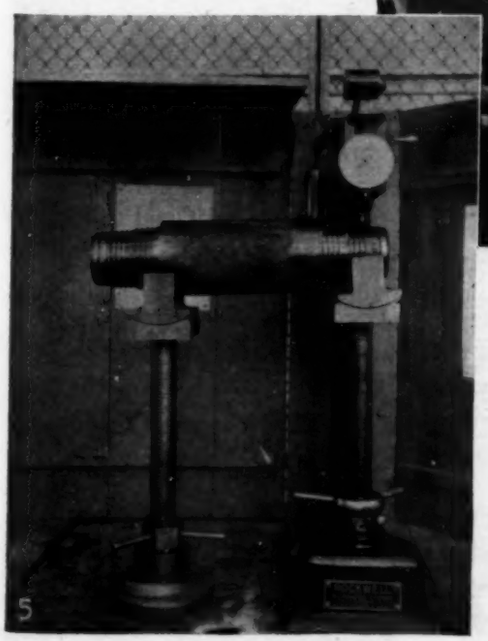
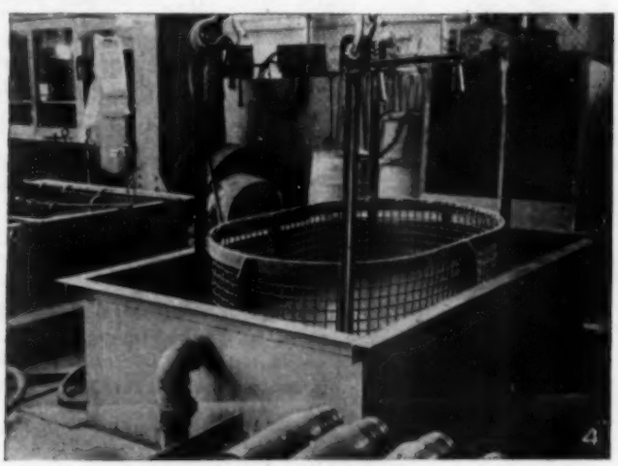


Fig. 5—Testing a tool joint after heat-treatment. These joints must sustain the weight of several thousand feet of heavy pipe, must be watertight, and have quick-coupling action

Fig. 4—Two quenching tanks are conveniently located. They are of large capacity and are set partly below the ground level. The carburizing boxes are handled by an overhead crane that passes over the furnace and tanks



Photographs by courtesy of the Doheny Stone Drill Company, Torrance, California

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions given at the foot of the page have been arranged

What You Do, or What You Get Done?

AFTER waiting impatiently for some time Al was about to drive off, when Ed came out of Williams' office.

"Sorry to keep you waiting, Al," Ed remarked soberly, as he climbed in.

"That's all right, old man. Waiting for you is the least of my troubles," said Al, seeing that Ed was troubled.

They drove through the city traffic without any of their usual wisecracks about the traffic cops or the people they passed. When they reached the suburbs, still in silence, Al ventured, "Something worrying you, big boy?"

"Yes, a whole lot. You know how hard I've been working to get that 6341 order finished on time, don't you?"

"Yes, What's the matter? Aren't things breaking right?"

"No, and it seems like the more you do around here, the less thanks you get. I'm about through."

"That isn't the way to talk, old man, the time to quit is not when you're under fire, but when you have things going right. Then you can look anybody in the eye and tell him where to go. Buck up! What about that order?"

"Well, we've been so darn busy on regular orders that it looks as though 6341 will be about two weeks late. I've worked my head off, and tonight I thought I would tell Williams it would be late, and what I had been doing to push it."

"Williams didn't act nasty about it, did he?"

"Well, no and yes. He told me that he knew how hard I had been working, and that he appreciated it. But just when I was getting all swelled up, he adds—'Still what really counts, is what you get done, not what you do yourself.' Do you wonder I'm discouraged? There isn't a man in my department that works at hard as I do, or a man in the plant that boosts Williams more than I do, and then I get a slam like that."

"But, Ed, Williams didn't say that to be nasty, he really likes you. He knows his book and what he said was a fact. This forenoon I waited fifteen minutes while you were laying off those bases. I noticed several men come up and stand first on one foot and then on the other, and then go away again, rather than disturb you."

"Is that a fact, Al?"

"True as preaching, Williams is right, Ed. You know yourself that your job is to see that the men under you are competent and dependable and that they have plenty of work laid out ahead of them to keep them busy every minute. You know how to do the work, but that isn't what you're hired for."

"Maybe you're right, Al."

Was Williams' statement sound? Is a white collar foreman to be preferred? Should Ed have cleaned house and built up a more capable staff so that he could have more time for supervision, or was the fault his own?

Idea suggested by Jack Sargent, Foreman, R. Wallace & Son Manufacturing Company

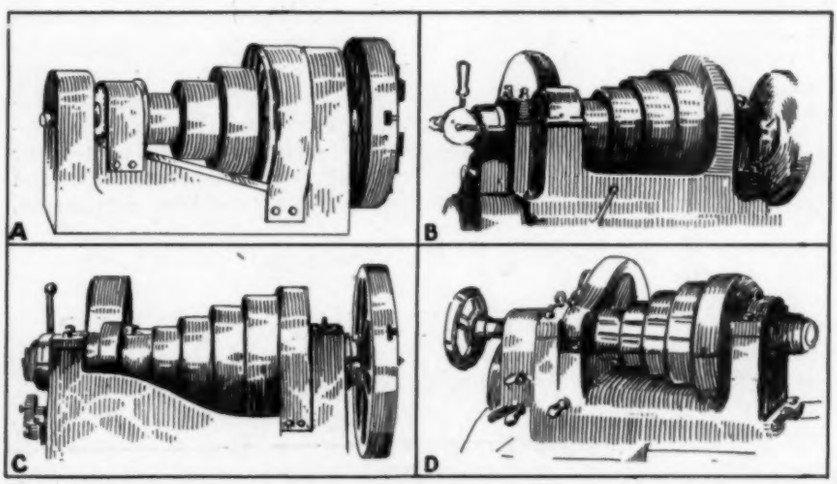
All foremen are urged to discuss these questions vital to their work; of course the disc

DISCUSSION OF EARLIER TOPICS

Stirring up the Foreman on Accidents

NOBODY likes accidents. But they will happen, and therefore it is up to foremen to make every effort to safeguard against them. I am writing this with a half finger missing from my right hand. The accident happened three weeks ago, therefore, I write from first-hand knowledge. It has always been my endeavor to prevent accidents, and I have done so with some success, never having had a serious accident in my department during 30 years. There have been, however, numerous minor accidents, chiefly with fingers or clothes catching in the machinery.

The designer can do much to prevent accidents, but in designing for this purpose care must be taken that in trying to safeguard against one kind of accident, a greater and more dangerous accident is not made possible. For instance, the cone pulley on many capstan-type lathes is guarded, as shown at *A* in the illustration, by a wall of metal in front. Many a man has had his hand pulled under when he was slipping the belt on or off one of the steps of the pulley by hand, but in most cases little damage was done. The design, however, as shown at *A* and *C*, makes a perfect trap, and I have known of two operators having their thumbs pulled completely off their left hand when slipping the belt. Of course, we may say that he should not have used his hand, but it is an operation which has to be performed hundreds of times in a week, and some operators have done it for years without accident. It is accomplished quicker and with less effort by hand than by any other means, hence, the risk is taken. I consider *B* and *D* comparatively safe. The foreman, knowing what machines are dangerous and what practices are unsafe, should take the trouble to warn his men against accidents. The men may not appreciate it at the time, but eventually they will respect him for his advice.



Various types of cone pulley guards, some of which are considered unsafe

Loose belts are the source of another danger. When not in use they are sometimes allowed to hang loosely on revolving shafts. These should either be tied up or taken off entirely. I have known of fatal accidents being caused by loose belts. Projecting set screws in loose collars on revolving shafts are another common source of danger that has caused many serious accidents, and the exposed camshaft on a gas or oil engine is a real danger. I once had the tassels of my neck muffler catch on a shaft on this kind. Fortunately, only one end caught, and as it was not tied, it slid off my neck, though it gave me a real shock at the time. I have had this shaft guarded, and have also pointed out the danger to others in those places where the camshafts are not guarded.

H. MAPLETHORPE, *West Bromwich, England.*

*

Why Some Tools Fail

USING new tools in old machines is one important reason why tools fail. The old machine is not equipped or constructed in a manner that will do justice to the use of the new tool, and foremen should not expect to get results from such a combination. The high-speed, steel tools were good enough for the old machines, but the new alloy, if given the opportunity, will prove its superiority in both the amount and type of work that it will do.

Using high-speed tools will pay, even if it means scrapping old machines. It is the net result that counts. If the new cutting tool can reduce machining time one-half, or even a quarter, it is just a matter of figures to show when to buy new machines.

Only by a combination of the best machines with the best tools is it possible to obtain the full working capacity from a high-power machine tool. It is a waste of time trying to save in the first cost of cutting tools, because the difference between the cutting capacity of inferior tools and that of the best is so great that the difference in price never justifies the apparent saving.—HARRY KAUFMAN, *Public Accountant.*

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Reporting Minor Accidents

AS LONG as people work around machinery and handle bulky objects there will be accidents. Most of them will be minor affairs, and, we hope, there will be a steadily decreasing number of serious ones. When an attempt to set a record is being made, there is an inclina-

the discussion is not limited to foremen. Letters accepted and published will be paid for

tion not to report any small accidental happenings that may mar the record. This is the wrong attitude to take, as every bump or cut should be reported and cared for, not because the injury may be serious, but because it should receive antiseptic treatment to prevent infection from developing.

Instead of trying for a no-lost-time record, all efforts should be directed toward accident prevention. The executives of the organization should change the method of doing work as safer ways are developed. The men should be taught to work safely at all times, and especially so, when they are likely to do something which may result in injury to another. As soon as they realize just how to work in safety they will take proper precautions, unconsciously, to safeguard themselves and others.

—L. O. BROWN, *Toolroom Foreman, Holcomb & Hoke Manufacturing Company.*

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The Man Who Shows Interest

FROM the point of view of the supervisor who works strictly by routine, the man who shows interest is a disturbing factor. Such a man is trained to be useful in a particular shop or department, and generally he becomes valuable. Then, when his usefulness is approaching its peak, he asks to be transferred to some other department. Usually, unless his request is granted, he is prone to take matters into his own hands and leave. There can be no question but that such a man is often a plant's most valuable asset, and he should, from this larger aspect of the plant's good, be encouraged. It is good for both man and employer to carry out industrial obligations in this spirit. When the man seeks increased scope for service and the company encourages him in the quest, both stand to gain.

—W. R. NEEDHAM, *Stafford, England.*

THE employee who takes a personal interest in the plant and its methods of manufacture is an exception, and will receive all the encouragement I can give him. I realize, that the employees who know for what the different parts are used and the "where and how" of the finished product, are the ones who are most valuable to me. Interest is a hard thing to stimulate in employees. Most of them just plod along. Much money has been spent trying to create interest, and when we meet an individual who is just naturally interested in his work, we feel good. The suggestion box, the bonus, the shop ball team, the shop club, the Christmas party, the shop library, all these things are intended to create interest in the work. One plant, where I was employed, as far back as twenty years ago used to require a new man to shift about the plant each month during his first year to enable the management to determine where he fitted into the work. I have always felt that I gained more genuine knowledge in that year than I have in any one year since.

—CHARLES H. WILLEY, *Asst. Plant Supt., Hoyt Electrical Works.*

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Committees for Definite Shop Problems

IF WE were living in Utopia, committees for definite shop problems might work out fairly well. Consider, for instance, the large plants, divided into various departments. In some of these departments men of high mental attainments and initiative are required, while in others the men are considered as just so many production units. The men in the first group are quite likely to take the initiative in bringing about the correction of any defects in their department, while the men of the second class are just as likely to leave well enough alone.

The interest of the committeemen must usually be stimulated by external means, and the final results arrived at by these various committees could be more easily accomplished by an energetic and sympathetic management in a shorter space of time.

Instead of committees, men in direct charge of departments should be encouraged to develop a more wholesome and understanding attitude toward the men under their control, and co-operation on the part of the men will grow in proportion.

—WM. SCHIRMER,

* * * *

THE · NEXT · TOPIC

"Instructors in the Shop."

The Man Who Shows Interest

Summary of the Discussion

A new man hired by foreman Ed exhibited an unusual interest in the operations carried on in other departments. While admitting that this man attended to his work and was a good mechanic, Ed was suspicious of his activities. Al advised him to encourage the lad, and even to take him around to different departments himself.

OPINIONS expressed by the various contributors to the discussion were unanimous in declaring that an intelligent interest in related operations and processes should be encouraged, it being, of course, understood, that the visits to other departments for the purpose of observation should not take place during working hours.

It was suggested by one contributor that a man who takes interest is a disturbing factor to the type of executive who works entirely by routine, because, as soon as such a man has become proficient at one operation, he insists upon being transferred to some other job.

The superintendent of a European shop related how a visit to the assembly department had given his machine men an entirely new viewpoint of the use of gages and tolerances. Another superintendent stated that it was difficult to stimulate interest in men, and that it was his experience that the man who knew the "why and how" of the different operations was much more valuable to him than the man whose knowledge was limited to his immediate occupation.

Tempering and Coloring Axes

By Wirt S. Scott

Special Representative, Westinghouse Electric & Manufacturing Company

A change from gas furnaces to electrically heated lead and salt baths resulted in a marked improvement in quality and a substantial decrease in cost

MAKING high grade axes to meet the exacting requirements of professional wood choppers has been the specialty of the Warren Axe Company, Warren, Pa. The axes are hand forged from the highest quality of crucible steel. Formerly, in order to secure the best results obtainable from fuel-fired furnaces, each axe was individually hardened and tempered.

Despite the utmost care in heat-treating and testing, the necessary free replacements after the axes have been sold becomes an appreciable item, and one to be eliminated if possible. This has resulted in extensive investigation of new ideas and new methods of heat-treating the parts, particularly as applied to tempering.

Prior to electrification, the axes were heated in semi-muffled gas furnaces. Individual treatment for each axe was thought to produce the ultimate in heat-treatment. The possibility for error in judgment on the part of the heat treater was appreciated, but this was minimized as much as possible by the employment of experienced, high grade heat treaters exclusively.

The "Sager Brand" axe is known by its color, a dark blue, the natural color of the tempered steel. The securing of this color in tempering the axes was the aim of the heat treaters, but the accomplishment was a matter of judgment alone, and subject to many variables,. resulting in different shades of tempered steel and different degrees of hardness. The desirability of improving the quality of product, and of securing a dependable uniform quality, was apparent, and a decision was made to eliminate some of the varibles and reduce others to a minimum through the use of electric heat, regardless of the operating cost.

> It was formerly believed that individual hardening and tempering of axes produced the ultimate in quality. It did in the case of individual axes, but the difficulty of obtaining uniformity in temper under varying conditions of time and temperature caused many replacements

Electric furnaces were put in operation February 1, 1929. The entire method of heat-treatment was practically reversed. Batch type, semi-continuous operation; bath type furnaces in place of hearth type; separate hardening and tempering furnaces; one hardening and one tempering furnace in place of five combination hardening and tempering furnaces—this was the program decided upon, based upon experience gained and results produced in other fields.

The electric furnaces are of the rectangular bath type, consisting of a box-like steel shell, riveted and welded together, and lined with heat-insulating and refractory brick to form a heating chamber. Heating elements, formed of return bend coils of nickel-chromium resistors, are suspended from hooks anchored in the side walls and also placed in the bottom in suitable refractory spacer blocks.

The axes are suspended by suitable hooks in heated lead and salt baths, held at the proper temperatures for the hardening and tempering operations. Because lead is heavier than steel, means must be provided for holding the axes down in the lead bath.

The hardening bath furnace is operated at a bath temperature of 1,405 deg. F. It has a vessel the inside dimensions of which are 22 in. wide, 60 in. long and 14 in. deep. The electrical capacity is 65 kw., 2-phase, 60 cycles, 220 volts. The bath contains 5,000 lbs. of lead.

The tempering bath furnace, operated at a bath temperature of 580 deg. F., has a vessel of which the inside dimensions are 12 in. wide, 46 in. long at the top, and 12 in. deep. The electrical capacity is 57 kw., 2-phase, 60 cycles, 220 volts.

Two thermocouples are used with each furnace, one of the protected type, located directly in the bath, and the other a bare type, within the furnace chamber. This double protection and control is necessary to protect fully the heating elements against excessive temperatures, particularly during the heating up periods at which time the temperature of the bath does not rise as rapidly as that of the heating chamber, and the chamber heat tends to rise much faster than it can be absorbed by the bath.

The production consists of two distinct classifications of axes, the "Sager Brand," blue tempered, and the various other brands under distinctive trade names. These later brands are finished in various colors of enamels, and are not required to have the blue finish. The production in one month consisted of the following:

6,400 blue finished axes, single bit.
9,500 blue finished axes, double bit.
10,900 in other finishes, single bit.
525 in other finishes, double bit.

Total number of bits, or cutting edges, to be heat-treated, 37,350 in the month referred to.

In the hardening bath, as shown in Fig. 1, 23 axes are suspended point down, and immersed in the lead bath to within one inch of the hole for the handle. On

top of the molten lead is placed a blanket or cover of granular carbon, which has the effect of reducing the radiation losses from the surface, reducing the oxidation of the lead, and giving a wiping action for removing lead globules from the axes. After the axes have been in the bath a definite length of time they are removed, quenched in brine, and rinsed in clear water. They are then ready for tempering.

A tempering salt is used, which, if held at the proper temperature for a definite length of time, produces just the shade of blue desired. The temperature, of course, has to be that required for a proper draw, and at the same time it has to be just sufficient for thorough saturation.

In the blueing process the axes must receive the finished polishing after hardening and before tempering. With the furnace now used a beautiful dark-blue shade is uniformly obtained over the body of the axe, and a slightly lighter shade over the cutting edge. Just as long as the temperature remains constant within certain limits, and the work is kept submerged in the salt for a definite length of time, the same shades of the blue are reproduced.

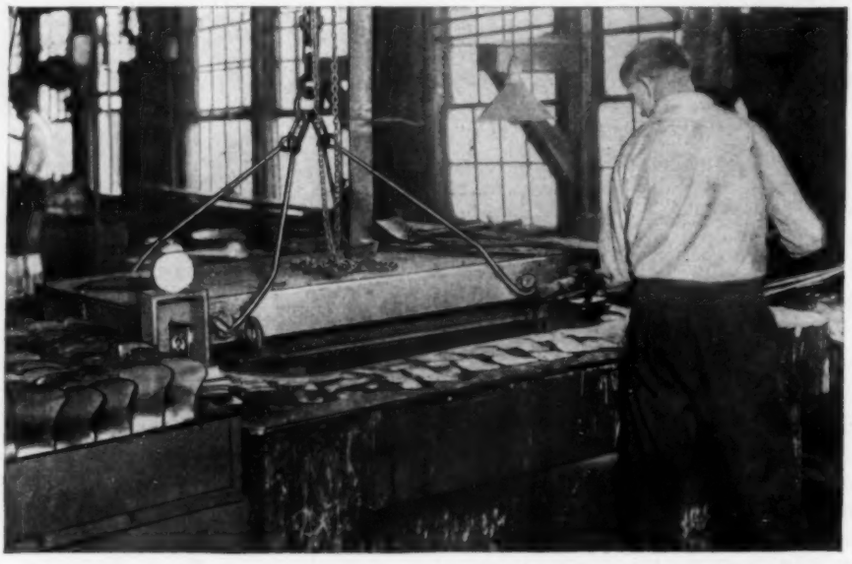


Fig. 1—Hardening furnace where axes are heated to 1,400 deg. F. in a lead bath. Means are provided for submerging the parts

One of the most interesting phases in the use of electric heat is the possibility of accomplishing results heretofore thought unattainable, and oftentimes the securing of unlooked for results which, in themselves, more than justify the installation.

An illustration of this fact was brought out in an attempt to obtain a much closer temperature control of both the hardening and tempering baths than had previously been obtained with electric furnaces. With bath type furnaces, the temperature of the bath adjusts itself but slowly to changes in the heating chamber temperature. For example should the temperature of the bath begin to drop below normal, and by doing so, cause to be liberated or turned on an increased amount of heat energy, the temperature of the bath will continue to drop from 30 to 50 deg. below normal (depending upon the type of furnace used) before it begins to rise again. This increased heat energy, or source, continues adding heat to the bath until normal temperature is regained. However, by this time, the entire furnace chamber, consisting of refractory brick, has been heated to a much higher temperature than the bath, and has absorbed a considerable quantity of heat which it begins to liberate to the bath as soon as the heating medium is reduced or cut off entirely. The net effect is to continue to supply heat to the bath after the proper temperature has been required, with the result that the temperature of the bath continues to rise from 30 to 50 deg. above normal.

Using an electric furnace, having one thermocouple in the bath and one in the heating chamber, it is possible to make the bath temperature respond more nearly to that of the furnace chamber, cutting off the current when the heating chamber reaches a predetermined temperature, thereby preventing an excessive storage of energy, and later, when the heating chamber has cooled off somewhat, cutting on the current again. This action anticipates, to an extent, the demands for heat within the bath. Such a system of control can be depended upon to hold the temperature of the bath within 20 deg. plus or minus.

Theoretically, if a definite amount of heat be supplied each minute to a batch, it should be possible to put just enough work through the furnace each minute to hold the temperature constant. This principle, in combination with the electric furnace above described, was put into effect. Since the axes had to be placed on the hooks by hand, and removed by hand, some positive means had to be employed to indicate to the operator whether or not he was operating at the production rate which would tend to keep the furnace at a uniform temperature. This was accomplished by the placing on the pyrometer three contacts, operating three lamps placed over the corresponding furnace. A white light indicated correct temperature; a blue light, temperature too low; a red light, temperature too high; a white and blue light, a downward swing in temperature; a while and red light, an upward swing in temperature.

With 23 hooks suspended over the hardening furnace, 22 of which always held axes, the operator's job was to remove one heated axe and replace it with a non-heated axe at such a rate as to keep the white light burning. Should the blue light come on with the white, the operator must slow up; should the red come on with the white, he must work faster. Should the white light go off entirely, the operator must cease work until conditions become normal.

In practice, it is impossible to comply entirely with the theory above outlined. The weights of axes vary, consequently, the rate of heat absorption is not constant, hence variable amounts of power is required at different times. This condition necesitates a furnace having a capacity sufficient for heating the largest charge at a given production rate, and, as a factor of safety, an excess capacity for unusual or unforeseen contingencies. The temperature variation of this combined system under the worst conditions was sufficient to hold the temperature within 15 deg. plus or minus of the desired temperature.

A control of the hardening temperature within 15 deg. was an improvement over any results anticipated, and the elimination of 80 per cent of the field rejects

was assured, provided the operator could be depended upon to watch his lights. A difficulty arose in this respect, however. One two-point control instrument was used on each furnace, the instrument, automatically, every 30 seconds, changing from the thermocouple in the bath to the thermocouple within the heating chamber. Since the indicating lights had to be connected to show the bath temperature, there was, therefore a period of 30 seconds out of each minute during which the lights did not burn. This resulted in much uncertainty and confusion. The situation was remedied by replacing the two-point instrument with two single-point instruments, one for the bath and one for the heating chamber, thereby permitting the lamps to burn uninterruptedly. Batch after batch was then put through with only the white light showing, indicating a temperature variation of less than 5 deg. F. Occasionally, the white and blue or the white and red lamps would come on, in which case, the operator gaged his speed so as to cause only the white light to show. At no time did either the blue or red lights come on, alone.

During the course of this investigation, the plant engineer was demonstrating the action of the pyrometers in control of the lamps, and in doing so, opened the case of the instrument, disconnecting the control lamps. The control room is in another room parallel to the heat-treating department, but cannot be reached directly from that department, necessitating walking the length of the heat-treating room, into the connecting room, across the room, and back an equal distance to a point directly opposite the furnaces. In less than two minutes after the pyrometer case was opened, the furnace operator appeared in the control room to learn why his lamps had gone out.

The operation of the tempering furnace, Fig. 2, is substantially the same as the hardening furnace, except that the entire axe is submerged in the liquid when tempering. With the double bit axes, the entire axe being submerged, only a single tempering operation is required per axe, whereas, with the hardening furnace, each double bit axe is run through twice, once for each blade. The timing is worked out on the same basis as with the hardening furnace, each weight of axe requiring a definite time.

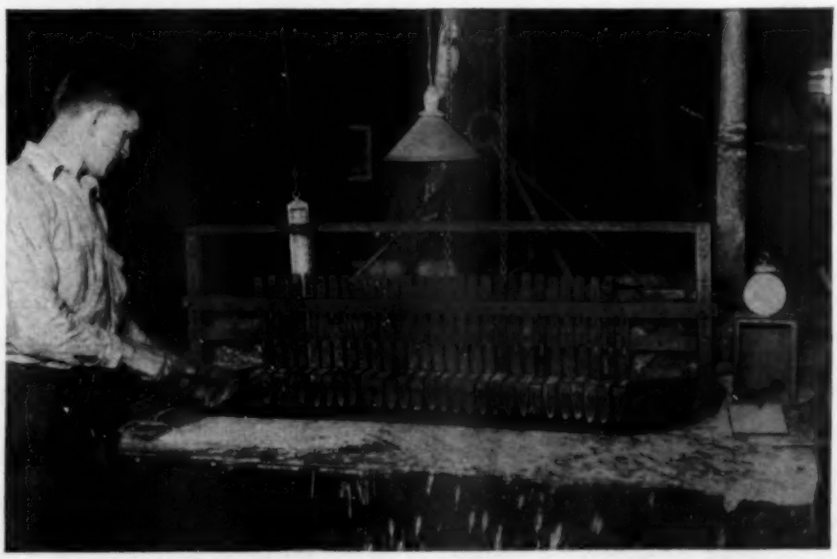


Fig. 2—Electrically heated salt bath in which the axes are tempered and colored uniformly

The use of two control instruments, two separate contactor switches, and two circuits in each furnace opened the way for an investigation for further refinement of temperature control that would give a still better product and eliminate field rejects due to improper heat treatment. As previously explained, the surging of the temperature had been reduced from 30 degrees to 20 degrees by controlling the temperature of the heating zone. If the amount of energy necessary for temperature control could be reduced, the corresponding fluctuation or surging in temperature would be reduced. This is accomplished by taking one circuit of the furnace entirely off the recording pyrometer and placing it on the control pyrometer for the heating chamber, with the net result that one-half of the furnace capacity was in constant service and one-half in intermittent service.

Since the electrical capacity of one-half the furnace was more than that necessary to supply the radiation losses, during the noon hour period when no work was being heated, the constant heat circuit is cut out and the temperature control circuit alone used for maintaining the temperature.

With the gas furnaces, 5 heat treaters were employed on a piece work basis to get out the production. The average daily production per man for hardening and tempering, was as follows:

Common axes, single bit	400 per day.
"Sager" axes, blue, single bit	325 per day.
Common axes, double bit	200 per day.
"Sager" axes, blue, double bit	165 per day.

With electric furnaces, one man hardening and one man tempering, the combined production is as follows:

"Sager" axes, blue, single bit,	1,500 hardened and 1,500 tempered.
"Sager" axes, blue, double bit,	750 hardened and 1,500 tempered.

The direct labor cost per 100 axes, hardened and tempered, using gas fuel, was as follows:

Single bit	$1.73 per 100.
Double bit	$3.46 per 100.

Since using electric furnaces, the scale has been adjusted so as to give the men the same wages in a 7 hour working day as they formally received for an 8 hour day. The direct labor cost per 100 axes hardened and tempered, is as follows:

Single bit axes	$0.85 per 100 axes.
Double bit axes	$1.24 per 100 axes.

The two furnace operators are on piece work, each man turning out from 1,400 to 1,500 axes per day, with an average of 1,435 each, for the past four months. These two men are now turning out a larger production than 5 men previously turned out on the fuel furnaces.

IDEAS FROM PRACTICAL MEN

The department, "IDEAS FROM PRACTICAL MEN," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Angle Dresser for Abrasive Wheels

By H. Q. MUNN
Walkerville, Ontario, Canada

A DEVICE for dressing an abrasive wheel at any angle is illustrated. For grinding form-cutting tools, which consist entirely of angles and radii, its usefulness will be apparent. It is designed for use on a magnetic chuck. It is compact, and the grinding wheel does not have to be raised as high for dressing as when angle plates and bars are used. The principal parts of the adjustable angle block consist of a taper base *A* and a taper disk *B*. The taper of each is 5 deg. The diamond block rides on the disk *B*, and against the guide *C*, which is held against the bracket *D* by a screw and a spring washer at its center *E*. There is sufficient clearance around the screw to allow the bracket *D* to turn in a vertical plane parallel to the center line of the disk, and to float with the different positions of the disk *B*, which is held by the spring *H*. The disk is graduated around its edge in increments of quarter degrees, but readings of approximately five minutes can be estimated, since one degree of inclination between the surfaces of *A* and *B* is represented by an arc of 12 deg. on the edge of the disk.

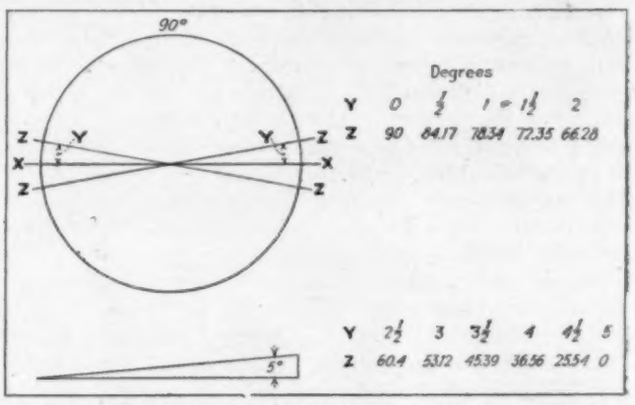


Fig. 2—Diagram and table of angles for setting the fixture

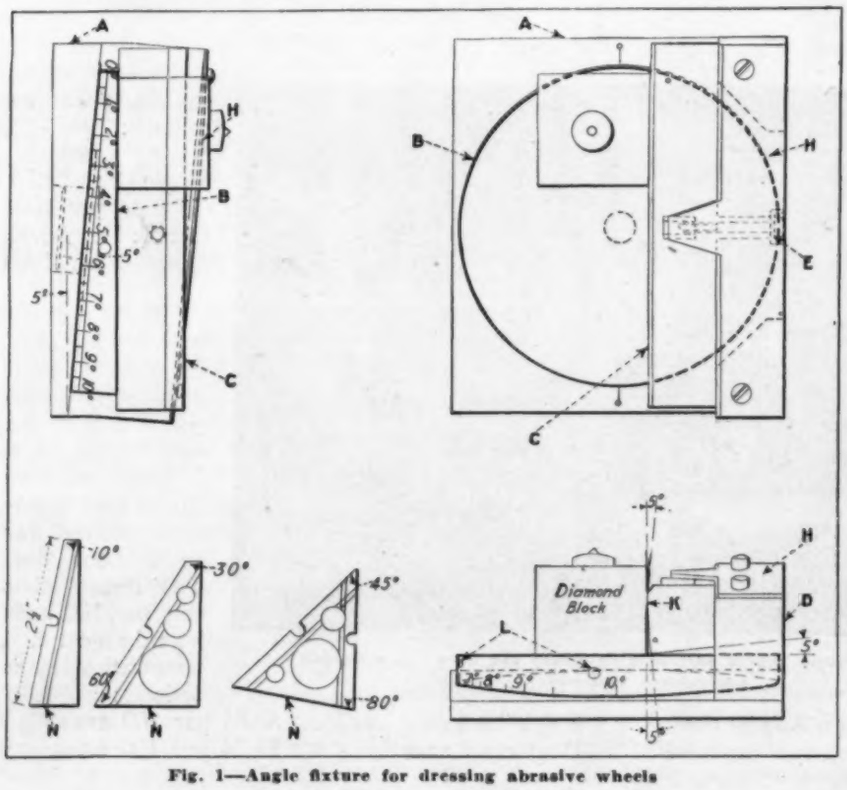


Fig. 1—Angle fixture for dressing abrasive wheels

By using the device in conjunction with the three blocks shown at *N* any angle from 0 to 90 degrees can be obtained.

The angle of the face of the disk *B*, on a section through the center line *X-X* changes from 0 to 10 deg., according to the formula, $Y = \tan 5 \text{ deg.} \cos. Z$, therefore, the diamond block must always be guided along this line.

Owing to the varying thickness of both the base and disk, the upper surface of the latter is sometimes inclined in two directions. This does not affect the accuracy of the given angle, because, as stated, the diamond block always moves along the center line, and the diamond makes only a point contact with the wheel. It will be noted that the guide *C* has been given clearance so that the diamond block never makes more than a line contact with *K*.

The table shown gives the angle to which the upper surface of *B* is tilted by a given rotation in relation to the center line *X-X* and the base. The values of *Y* and *Z*, given in terms of degrees for both rotation and inclination, are tabulated.

There are two equal sections of the disk for any value of *Z*, measured either side of the axis *X-X*. The disk is graduated symmetrically from each end of the axis, and by revolving *B* any angle from 0 to 5 deg. can be added or subtracted, giving a variation of 0 to 10 deg. The disk is moved by means of pins inserted in pinholes

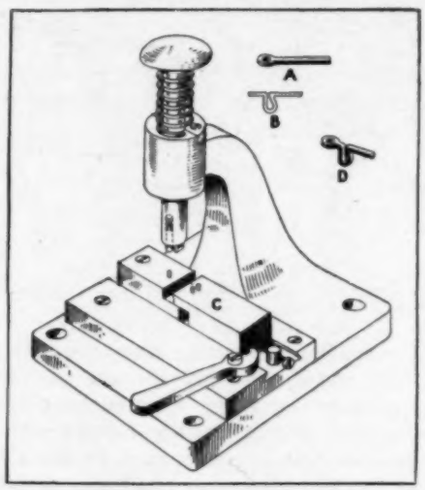
L around the edge. The upper disk *B* is maintained in alignment with the lower disk *A* by means of a hub, or pin, that fits into a corresponding hole in this latter disk.

Bending Fixture for Terminals

By Charles H. Willey

Asst. Plant Supt., Hoyt Electrical Works

Bending the blank *A*, which is of 0.020-in. brass, to the shape shown at *B* is accomplished by the fixture illustrated. The production is at the rate of 650 per hour. Girls are employed to operate the fixtures.



Terminal bending fixture

In operation, the blank is placed on a pin on one side of the die, and the tongue is held between other pins on the movable slide *C*. When the plunger is brought down, the punch bends the blank downward. The slide *C* is then moved to the left by the lever at the right, bending the loop as shown. Slightly releasing the plunger and moving the slide as far as it will go, allows the loop to be formed, while the top of the blank remains flat. A disappearing hollow-pin holds the blank down during the bending. At *D* is shown one of the finished parts.

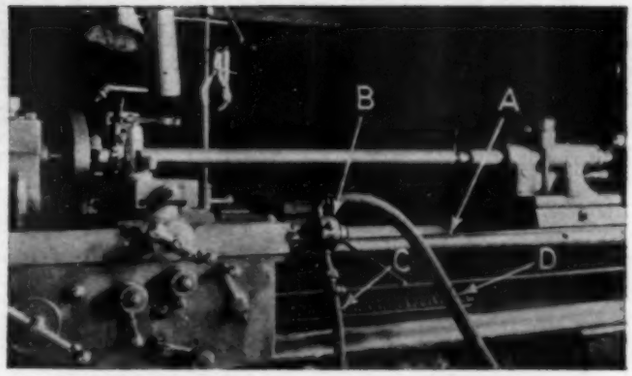
An Improvised Hydraulic Carriage-Return

By C. D. Michener

It has been said that we work hard because we are lazy. The farmer's boy will hoe all the potatoes today so that he can go fishing tomorrow. Here is a case in point. We had a lot of screws, 36 in. long, with left-hand threads, to be cut in the lathe. Running the carriage back to the starting point after each cut soon became tiresome, which made the operator think of some way to ease his labor.

Searching through the scrap pile, he found a piece of tubing with a 2-in. inside diameter, a piece of old $1\frac{3}{16}$-in. shafting, and a four-way valve from an old air hoist. After welding he had a head in one end of the tube. With the tube for a cylinder, the shaft, with a cup leather on one end, for a piston, and the four-way valve, he had the makings of a hydraulic return.

As shown in the illustration, one end of the tube *A* was screwed into a tapped hole in the front wing of the carriage, and the valve *B* was attached to the tube by a nipple screwed into a hole tapped in it. The outer end of the piston was made fast to the shop wall by a bolt. Water under pressure from the city main was brought to the valve by the hose *C*, and was discharged from the cylinder through the hose *D*. By operating



A hydraulic return for the lathe carriage

the four-way valve, the carriage was brought back to the starting point after each cut, quickly and by power. This hydraulic return for the carriage reduced the time on the job 50 per cent and brought smiles to the operator where there were only frowns before.

Two Hydraulic Presses for Railroad Shop Use

By I. B. Rich

Convenience and ease in getting work in and out of the press led to the designing of the two hydraulic presses shown. The small press, Fig. 1, is designed for pressing small bushings into place in levers or arms such as the one shown in position. The press is built next to the floor to avoid the necessity of lifting the work. It is designed for a pressure of 1,500 lb. per sq.in. The

Fig. 1—Hydraulic press for handling small bushings

heavy coil spring returns the plunger and also forces the liquid out of the pump cylinder.

The other press, Fig. 2, is also built low, and for even greater reason as the driving box and its crown brass are much heavier to handle. As shown, a crown brass

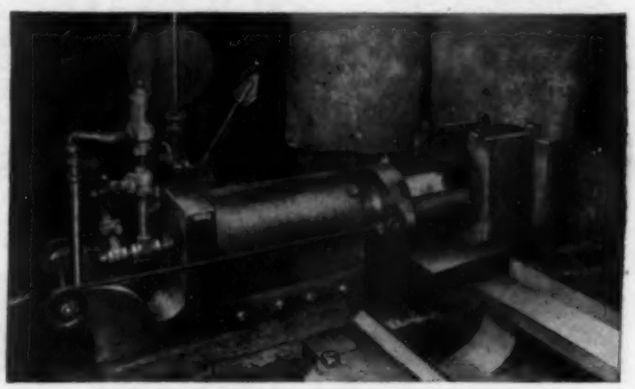


Fig. 2—Special press for forcing crown brasses into driving box

has just been started into the driving box. Instead of a spring the ram is provided with counterweights, sunk in suitable openings in the floor, and connected to the ram by wire cables. This press has a capacity of 50 tons, and is provided with a safety valve that can be set to relieve the pressure at any desired point. The operating lever is shown over the barrel of the press.

Finishing Connecting Rods and Valve Tappet Guides

By Charles F. Henry

The cost of many machine operations depends largely on the ease with which the work can be handled in the machine or fixture. Fixtures that require the use of a separate wrench are giving way to those in which the work can be fastened by moving a suitable handle or lever. Accuracy must also be considered, involving the design of fixture to avoid springing of the part.

A good example of such clamping is seen in Fig. 1, where the connecting rods are located by the studs in the small end and held, without spring, by the clamps *A* that bear against the outer edge of the bolt boss. This fixture holds two rods on each side so that two rods can be loaded while the others are being bored. The boring bars are guided in long bearings mounted in a heavy, well-supported casting that forms part of the fixture.

Another example is seen in Fig. 2, where a valve tappet guide is being finished with a push broach. The guide casting is rather light, and is clamped opposite the milled surfaces by which it is located against the side of the cylinder block. The levers *A* force the swinging clamps against the work.

Both of these jobs from the Marmon Motor Car shops.

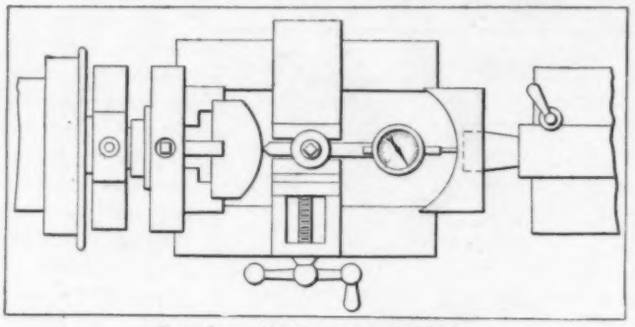
Attachment for Convex Facing

By Charles Kugler

Engineer, General Electric Company, Philadelphia

For facing the convex end of a punch, the radius of which is beyond the limits of the compound rest, the attachment shown in the illustration is made and put on the lathe. In such cases of facing, it is generally the practice to rough face and then file and scrape the work until it fits the templet; a cut and try method that takes much time and patience.

The attachment consists of a sheet-brass former plate, soldered to a shank fitted in the tailstock spindle of the



Forming attachment for a lathe

lathe, and a dial gage, held in the rear end of the toolholder. With the lathe running slowly and the power cross-feed in engagement, the carriage is moved back by hand, keeping the spindle of the dial gage in contact with the former plate so that the gage reads zero in all positions of its cross travel. The attachment is a great time saver, and by its use much better work is produced in less time than by cut and try method. Since the attachment costs little, it should soon pay for itself.

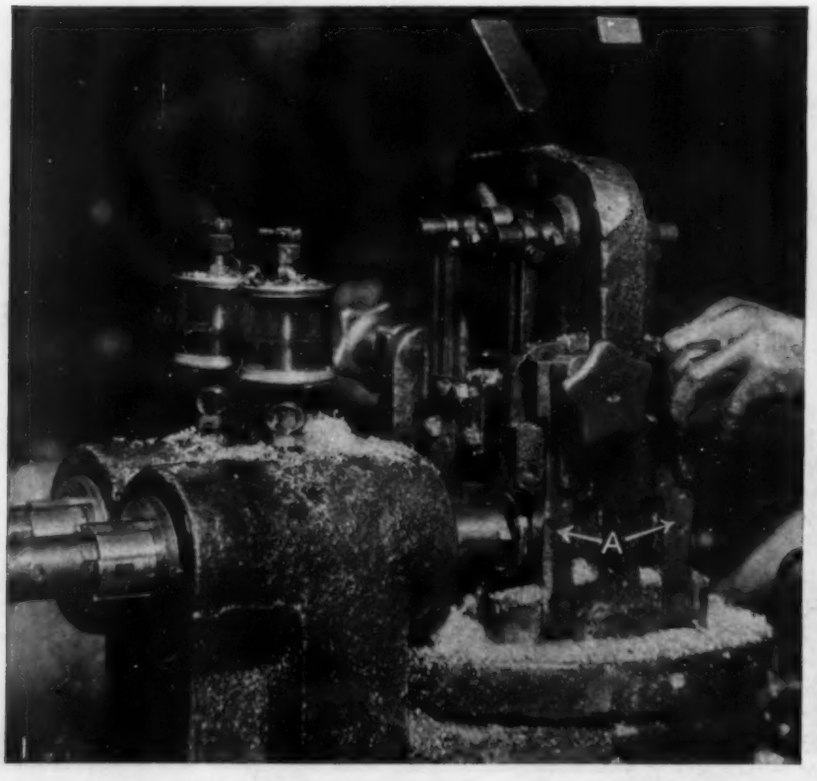


Fig. 1—Finish boring connecting rods on a double fixture.

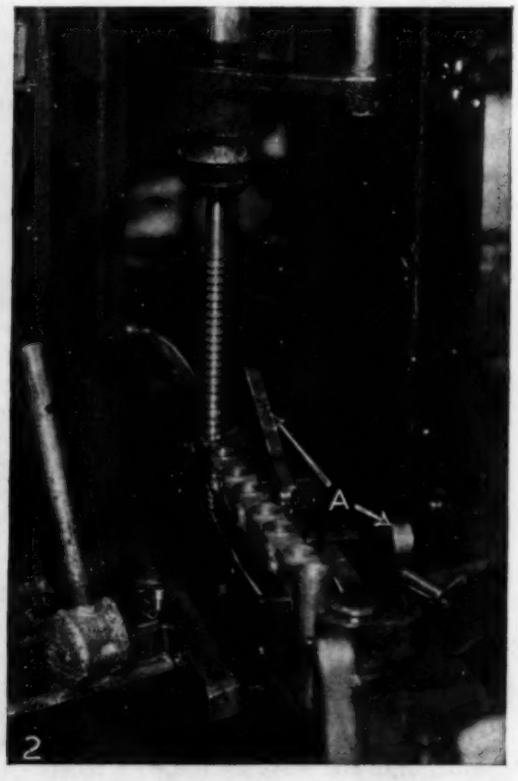


Fig. 2—Broaching valve tappet guides with a push broach

Rustproofing Processes

Parkerizing, Sherardizing, Calorizing

RUST, formed by chemical action of water, oxygen, and iron, is visible evidence of the destruction of iron and steel. Without actual getting together of the iron, water, and oxygen from the air, there can be no rust. Polished iron or steel kept perfectly dry will stay polished, or a covering that excludes moisture will retain the polish. The problem of rustproofing thus becomes one of protecting a surface.

There are three methods of rust prevention:

1. Application of an organic substance, such as painting, lacquering, or enameling.
2. Application of an inorganic substance, such as galvanizing, electroplating, or metal spraying.
3. Chemical conversion of the surface, such as browning, bluing, or blacking.

Parkerizing, Sherardizing, and Calorizing belong to the conversion method. The surface of the metal is converted by various means to form a rust-resistant coating. Sherardizing also may be considered as a method of the second class, since the metallic zinc is actually a coating, although chemical action takes place in application. An outline of the three methods is given in the following paragraphs:

Parkerizing

Parkerizing consists of changing the surface of iron and steel by chemical action, thus forming other substances that will not change into rust. The substances so formed are basic iron phosphates insoluble in water and permanent in air. The process is a development from two English patents, one by Thomas Watts Coslett, the other by Frank Rupert Granville Richards. Improvements made by the present owners include the addition of manganese and other metals to the acid, and the development of a chemical test whereby the strength of the solution can be controlled easily.

Three operations are necessary in Parkerizing: Cleaning, processing, and finishing. With the processing solution at the proper strength, success in the coating depends entirely upon thoroughness in cleaning. Any method of cleaning that produces a chemically clean surface is satisfactory. Parts that have been machined all over need not be cleaned further. Pickling or sand-blasting may also be used.

Processing requires 40 minutes to 2 hours in a bath at 210 deg. F. During the processing, particles of iron on the surface are replaced by particles of iron phosphate. Finishing consists of the application of a neutral mineral oil to bring out the characteristic grayish-black mat finish produced by this process. An additional chemical dip may be used to improve the rust-resisting qualities before the finishing operation. Drying may be either air dry or oven dry.

Paint may be applied to a Parkerized surface. All physical properties are unchanged. The piece may be tempered or magnetized, but not soldered or spot welded. The coating does not exceed 0.0003 in. in thickness.

Sherardizing

Sherardizing is the process of coating an iron or steel article with metallic zinc by heating with zinc dust. It is done chiefly for rustproofing purposes, but the coating sometimes is put on for appearance. The process, which was discovered by Sherard Cowper Cowles, an English metallurgist, consists in charging the metal articles into a drum with zinc dust, the drum being rotated in a furnace at a temperature of from 625 to 780 deg. F. for a period of 4 to 6 hours, then cooled on frames from 12 to 15 hours.

A thoroughly clean surface on the article is necessary for Sherardizing. The material must be packed in the drums so that no violent tumbling will occur. After several complete rotations to mix the charged material well, the drum need only be rotated once every 15 minutes. If the drum is opened with the temperature too high, the zinc will oxidize and the finished piece will be dark.

The pores of the iron become filled with zinc and a complete, even, adhesive coating is obtained, that, if properly applied, will not flake, peel, or scale. Articles so coated may be bent, swaged, or deformed without breaking the coating. Sherardized articles may be finished by polishing and buffing, and the zinc coating is capable of taking a top finish of nickel or other metal plating. The coating is from 0.001 to 0.002 in. thick.

Calorizing

Calorizing is a process whereby aluminum is driven into the surface of another metal, usually mild steel, to form an aluminum alloy. Upon subjection to heat, a very thin film of aluminum oxide is formed on the surface of the metal, offering protection from oxidation to the underlying steel. The metal so processed is unaffected by heat up to maximum metal temperature of 1,650 deg. F. and is not affected by high-sulphur crude oil, does not crack, chip, or scale, and presents a ductile surface.

The Calorizing process is adapted particularly to the manufacture of equipment for cracking stills in oil refining, because of its ability to resist corrosion by high-sulphur crude oils at high temperatures. Bolts and nuts, pressed steel pots, and protection tubes also have been treated by this process.

Calorized parts resist corrosion in that the aluminum alloy is immune to rust. The surface upon which it is done receives a thin coating of metal which may be provided for by making allowances in machining the piece before Calorizing.

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Pensions or Poorhouses

IF, as some managers contend, it is bad economy for modern industry to employ men beyond the age limits of forty and fifty, these same managers must ponder the worse economy of pensions or poorhouses for able-bodied, jobless men and their families. Hungry, desperate men are neither pleasant to see nor safe to have among us. It is grimly paradoxical that as modern industry has been lowering and tightening its age limits, modern science has been lengthening human life.

Since men will insist upon living beyond forty and fifty, they must be provided for. Give them decent productive work, and we add to the wealth and well-being of the nation; give them doles and pensions and poorhouses, and we add misery.

Pensions and poorhouses are, after all, supported by taxation, and industry pays a more than goodly share. As industry further replaces agriculture as the chief wealth-producer of the United States, it will have to pay an ever-mounting share. The burden is not shifted by taking men off the pay roll and adding them to the tax budget.

Though some managers insist that age limits of forty and fifty are good economy, some farther-seeing managers are finding to their profit and peace of mind that there is thoroughly good economy in employing men far beyond those limits.

*

The Tariff Annoys Business

ONE of the few certain facts about the tariff is its ability to annoy business during the periods when revision is under way. The present is no exception. When the rates are set and the administrative rules determined, business can adjust itself to the inevitable, but when changes are imminent future plans must be held in abeyance.

American business is at least measurably better off than business in other countries because revision of the tariff only takes place every six or seven years instead of overnight, as is frequently the case elsewhere. But the chances of revision being completed during the present special session of Congress are becoming more remote. If no law is passed before the session ends it will surely be many months before the regular session can get such an act through the legislative mill, because in the Senate the tariff will no longer be unfinished business.

Business, therefore, must be prepared for the rather protracted annoyance that will result from continued tariff uncertainty.

*

A Half Century of Electric Lighting

FIFTY years ago this week Thomas A. Edison reached a point in his experiments with a carbon filament lamp and an electric generator that may fairly be called the beginning of the present electric light and power industry. Both in this country and abroad there is some contention whether Mr. Edison should be credited with the invention of the carbon lamp. Several others apparently have as good or better claims. But Mr. Edison's contribution was bigger than a lamp. He saw behind the lamp the generating and distributing system without which it would be but a curiosity, and because of that vision and the hard work that went so far to make it a reality, he is thoroughly deserving of the great celebration that is being held in his honor this week. It is especially fortunate that Mr. Edison has been granted an unusually long life, and thus the privilege of attending his own jubilee.

*

Railroads Can Now Order Tools

RAILROADS, according to all accounts, are getting their hands on some real money. Net operating income of first-class railroads is estimated at $121,000,000, an increase of about 21 per cent over last year. If, as has been promised in the past, they will buy new shop equipment as soon as they get the money, railroad shop managers ought to get some of the machines they have been needing so badly for a long time. It is an opportune time for them to urge their need of new machinery, pointing out, of course, the savings to be secured by its use. These savings come not only from the reduced labor cost in the shop but from the reduction in the idle time of locomotives and cars out of service. Locomotives in the back shop cannot earn dividends. Every day saved in getting them back into service enables them to earn more money for the stockholders.

SHOP EQUIPMENT NEWS

Cleveland Model M, 7-Inch, Five-Spindle Hydraulic Chucking Machine

EMBODYING complete means for hydraulic operation in the rapid machining of castings, forgings, and similar products, both first and second operations, a 7-in. Model M chucking machine has been announced by the Cleveland Automatic Machine Company, Cleveland, Ohio. Hydraulic chucking, according to the manufacturer, is conformable to variations in the diameters of castings or forgings and provides a constant, positive force that is sufficient to hold the work against the maximum cutting feed of the tools. In addition, it can be adjusted to a lighter grip for work which is likely to be distorted. Another feature of the 7-in. Model M is the accessibility which permits the operator to tool the machine from the front, thus saving time ordinarily lost while going to the back to make adjustments in the set-up.

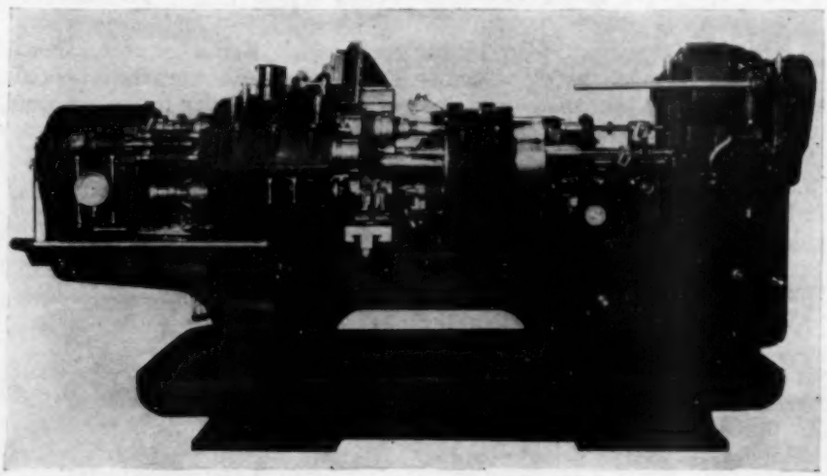


Fig. 1—Cleveland Model M, 7-Inch, Five-Spindle, Hydraulic Chucking Machine

The barrel type of tool turret which follows the conventional design in Cleveland Model A and M machines, moves back and forth in the wide bearings on the tool turret housing and is kept in alignment by a large key which is anchored in the tool turret housing and which fits into a spline cut lengthwise in the tool turret. To provide for the takeup in case of wear, the wedge is slightly tapered on both sides. Positive grip on tools is assured by double clamping bushings, one on each side of the turret holes.

An extra attachment to the tool turret has been provided, in addition to the usual assembly, permitting tool combinations that would otherwise be complicated if carried out in one tool design. This attachment is mounted in the center and extends beyond the face of the main tool turret, with a series of Tee slots running lengthwise along the five sides.

Tooling sequence of the standard machine provides for standard tools in the Nos. 1 and 2 positions that advance with the turret at the same feed per revolution. In the Nos. 3 and 4 positions (upper rear and top) the tools are clamped in independent revolving spindles, moving longitudinally in the tool turret, but individually controlled by levers, actuated from a drum and cams, mounted on the upper cam shaft.

The loading station is the upper front, or fifth position, and is also controlled independently, but does not revolve. Spindles 3, 4 and 5 can be cammed to complete their operations ahead of, or at the same time, as the other cutting tools. Threading, tapping, or extra revolving spindles can be arranged for if desired.

The hydraulic unit consists of a high-pressure variable delivery pump, a low-pressure gear pump, a stroke control lever, a pressure changing mechanism and a built-in control valve, all contained in a single unit and mounted in the oil supply reservoir, located at the right-hand rear end of the machine and driven at constant speed by a silent chain from the feed bracket.

The high-pressure delivery pump is of the five-piston type insuring a smooth and constant volume of oil at all times, regardless of the pressure. When the maximum pressure is reached, the delivery of oil is reduced automatically.

The low-pressure pump provides the back pressure on the high-pressure pump and also serves to operate the stroke control lever, which regulates the delivery of the pump from 20 to 550 cubic inches of oil per minute. A pressure regulator, which can be adjusted while the machine is in operation, affords a variation in pressure from zero to 1,000 lb. per sq.in. A control valve, built into the body of the unit, serves to control the action of the pump.

A single automatic valve, patent applied for, is located at the rear of the spindle turret and between the work spindles, and is connected direct to individual oil cylinders, mounted one on each spindle, and controls the opening and closing of the chucks. This five-way valve is designed so that the pressure is maintained on four cylinders while the fifth cylinder is operated for opening and closing the chuck. Either hand or automatic operation of the oil cylinders is provided for, as convenience may require.

The spindle turret is a semi-steel cylindrical casting, accurately ground to size, with provision for take-up in case of wear. The work spindles are made from alloy steel forgings and mounted on Timken roller bearings (two on each end of the spindles) and driven by hardened alloy steel gears from the main drive shaft. This shaft passes through the center of the tool and spindle turrets to the main

drive bracket at the right-hand end of the machine and is covered by a steel sleeve. The indexing cam is located on the lower camshaft, which also carries the chucking control cams.

Stop spindle mechanism is entirely automatic and is controlled from an

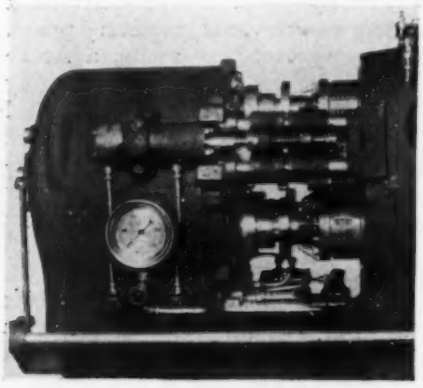


Fig. 2—Close-up of the hydraulic unit built into the left end of the machine

independent oil cylinder mounted between the spindle turret and hydraulic unit. It is operated from an independent oil line, connected direct to the low-pressure pump, engaging and disengaging the spindle drive clutch and at the same time applying the spindle brake mechanism to stop the spindle rotation. All flexible connections are made with ball joints to guard against leakage.

Spindle change gears are provided to cover a range of twenty speeds, from 61 to 756 r.p.m. The gears are mounted on the ends of the drive shafts, which extend through the main drive bracket, affording quick changes, and these gears are covered by a swinging guard. Constant tool feed per revolution of the work is maintained, and is in no way affected by the changing of the spindle speeds.

The fact that the main bed casting and the spindle and tool turret housings are cast integrally assures rigidity, minimizes vibration, and maintains permanency of alignment between the work spindles and the turret tools. Pan and oil reservoir are cast in one piece and designed to afford ample space for chips. The oil reservoir is divided in the center by a baffle plate, so that foreign matter settles in one chamber, while clear oil passes over the plate to the second chamber from which the cutting oil is pumped. A large capacity pump insures a constant supply of cutting lubricant to all the cutting tools at all times.

The main drive bracket is mounted on the right end of the machine and can be arranged for either belt or motor drive, using a.c. or d.c. constant-speed motors. Power is transmitted through a multiple-disk friction clutch, mounted in the belt pulley or driving sprocket, and controlled by a hand lever within reach of the operator. The clutch can be adjusted by releasing a spring pin and turning the finger block in either direction until the proper tension is obtained.

Two cam shafts are provided. The upper shaft carries the wormwheel and drum for the accelerated spindles, tool turret, and cross-slide drums. The lower shaft carries the indexing and wedge operating cams, spindle brake, and chucking control cams. The wormwheel, mounted on the extreme end of the upper shaft, has T-slots cut in the outer face and carries the adjustable feed trip pins for shifting from the slow, or working, feed to the high, or indexing, movement.

Three forming slides are provided as standard equipment. The two lower slides (front and rear) operate independently of each other. They are controlled by cams fastened upon the periphery of the operating drums and accelerated by cast steel bell cranks connected direct to the slides.

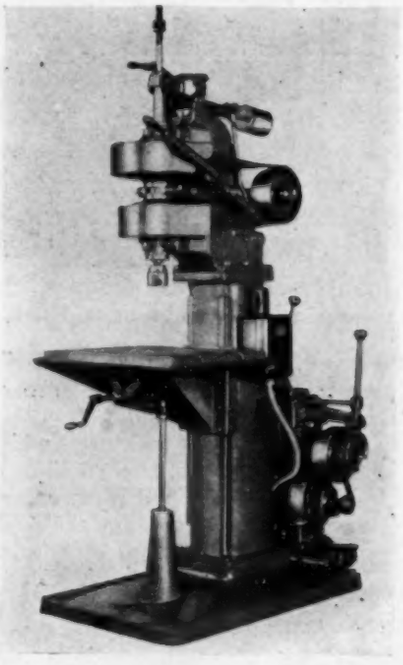
A double top slide is mounted on the spindle turret cap and affords two forming stations in the third and fourth positions. The movement of this slide is from a cam bar, acting directly on a roll mounted on the slide proper and connected by a cam disk having a cam bolted to its face.

Tool feed is independent of the high-speed indexing movement and is controlled by trip pins carried in T-slots in the face of the wormwheel. The distance between the pins can be arranged to suit the length of the cut. The pins engage a pawl on the trip lever, shifting the clutch from high to low or vice versa.

Frew No. 2 Automatic Tapping Machine

RATED to tap from ½ to 1¼ in. U.S.S. threads, the No. 2 automatic tapper has been placed on the market by the Frew Machine Co., 124 West Venango St., Philadelphia, Pa. The features of the head are similar to those of the No. 1 machine, which was placed on the market several years ago. The head is Timken equipped and the reverse pulley is of smaller diameter than the tapping pulley, so that the tap comes out of the work at a rapid rate. The operator sets the stop on the spindle for the depth he desires to tap, a maximum of 3 in. being possible, pulls the handle, and the tap enters the work, reversing at the predetermined point. The table is equipped with two T-slots and is raised and lowered by means of a screw and bevel gears. A ball thrust bearing supports the table. A 24x20-in. table is used. The distance under the chuck is 18 in. and from the center of the table to the base of the column is 10¼ inches.

This machine can be furnished for several types of drive. For belt drive a unit is bolted on the back of the column and provided with a two-step cone. For a greater range of speed, a four-speed gearbox, operating in a manner similar to an automobile transmission is supplied. The gearbox driving shaft is belted to the idler pul-



Frew No. 2 Automatic Tapping Machine

ley on the head, and the other shaft is belted to the overhead lineshaft. This gearbox is provided with a sturdy friction clutch and the gears cannot be shifted when the clutch is thrown in, as the gear shift lever is then locked automatically. Timken roller bearings are used in the gearbox.

For motor drive, a 3-hp. 1,200 r.p.m. motor is mounted on the base and power is transmitted through a chain to the clutch. If desired, belt drive can be furnished in place of the chain or flat belt drive. The spindle speeds are dependent on the size pulley placed on the gearbox. Using a 1,200-r.p.m. motor and a 4½-in. diameter pulley, the spindle speeds are 81, 106, 137, and 177 r.p.m. Using an 1,800-r.p.m. motor, these speeds are 121, 160, 205, and 265 r.p.m. Provision is made for adjustment to take up the stretch in the belts.

Gleason Four-Spindle Manufacturing Gear Rougher

THIS machine was designed and built by the Gleason Works, Rochester, N. Y., for rough-cutting straight bevel gears in large quantities. It was designed primarily for gears of the sizes ordinarily used in the differentials of automobiles or other gears of sufficiently large quantities and not exceeding 4½-in. outside diameter and is completely automatic in operation, including even the loading and unloading. The gears fall down chutes at each station to pans.

The entire machine, with the exception of the cutter drive, is hydraulically operated. Four blanks can be cut simultaneously. These are mounted on four independent work heads arranged around the cutting tool, a disk milling cutter 20.8 in. in diameter having 32 inserted blades. The main cutter spindle is mounted top and bottom in large anti-friction bearings lubricated by a small double plunger pump operated from a cam on the drive shaft in the gear box.

Each work head is adjustable to set the work to the proper root angle and cone distance.

In the operation of the machine, each work head is fed into the cutter to cut a tooth slot in the blank and then moved away to permit indexing. After all teeth are cut, the work head backs away from the cutter approximately 5 in. to the loading position, the cut gear is automatically pushed off the arbor, and a new blank is taken from the magazine by an automatic loading mechanism and is placed on the arbor and clamped in position. The head then returns to operating position, and the cutting and indexing cycle commences on the new blank. All of these operations are automatic, the operator needing only to keep the four magazines supplied with blanks. An automatic safety control prevents the feed movement from starting in case the blank is not properly placed on the arbor.

The index mechanism is of the notched plate type. The movement of the piston which controls the indexing operation is constant for all numbers of teeth within the range of the machine, so that it is only necessary to change index plates to cut different numbers of teeth. The travel of each work head is controlled by the adjustment of a stop dog, and the speed of movement is governed by a cam which controls the opening of the main work slide control valve. Reversing is effected through an arrangement of two valves, one of which is mechanically tripped by the slide action and delivers pressure to each end of a piston-type valve, which in turn operates to deliver the working pressure to each end of the main cylinder. This eliminates the necessity of any mechanical "help over" and results in very closely defined movement of the slide with no material overriding at the end of the stroke.

The time of movement of the work head to loading position is governed by an adjustable control device which can be set for gears of any number of teeth up to thirty. As the work head slide moves away from the cutter after cutting each tooth, this control device is indexed one notch, and when the last tooth is finished, the control device trips to swing the work head slide trip dog out of the way, permitting the main piston to run back to its extreme position for loading. The control device then automatically resets itself.

The loading operation is controlled from a series of valve ports cut into a single drum so that it is impossible for the various operations to get out of time with each other.

The work heads are entirely independent of each other so that any or all of the four heads can be in operation at one time. In many cases, several different gears or pinions may be roughed satisfactorily at one time with the same cutter, but this should be determined by making layouts of the tooth shapes, as the cutter is designed to leave little finishing stock.

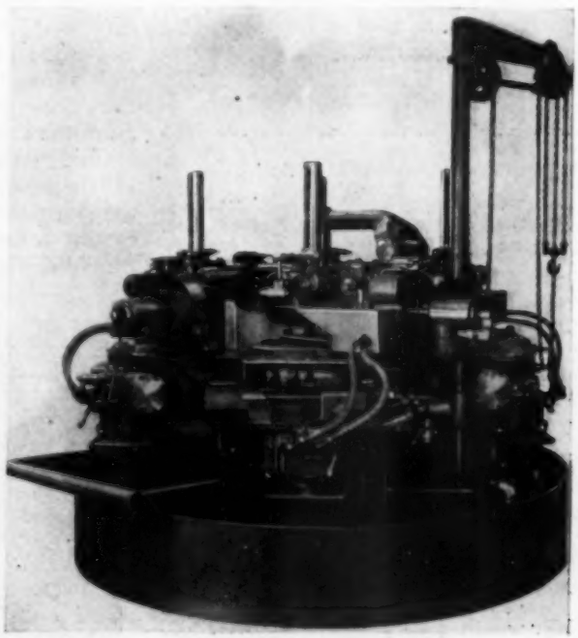


Fig. 1—Four-spindle gear rougher showing the operating mechanism, chip chute, and crane for handling the cutter

Placement and removal of the cutter is effected by a crane and chain hoist. A substantial supporting bracket is bolted to the central column,

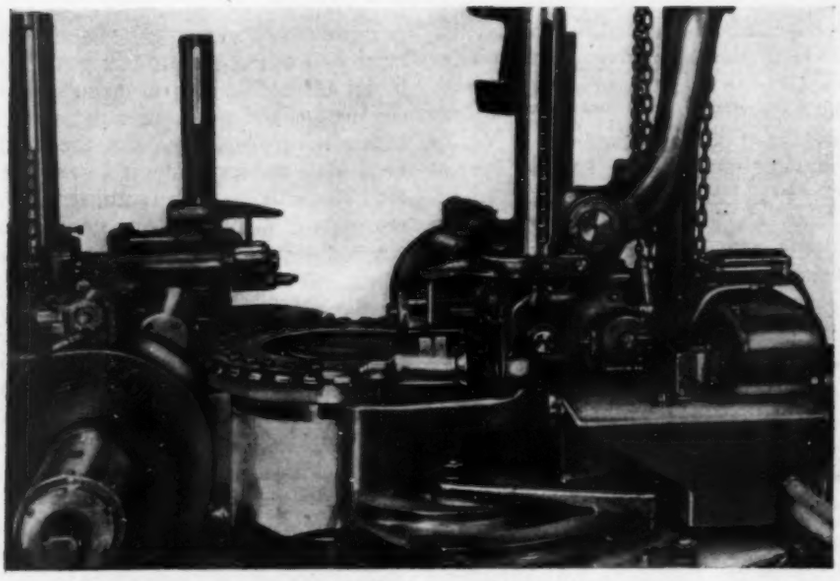


Fig. 2—Close-up view of cutter, gear holding mechanism and magazines for blanks

and supports the crane standard and cutting oil feed pipe. A swivel valve joint is embodied in the arm carrying the cutter guard inside of which are housed the four supply pipes that convey the coolant to the cutter at the cutting positions. When the cutter guard is swung up to permit access to the cutter, the cutting oil is shut off.

Two compartments are located in the base, one for 100 gal. of cutting oil and the second for the hydraulic oil which is of a light lubricating body and is pumped into a pressure chamber which serves as a stabilizer and largely contributes to holding the pressure continuous.

Cutting oil is supplied by a centrifugal pump of 45 gal. per minute capacity. Lubrication of the cutter and drive spindles, and of the bearings throughout the machine, is effected by two pumps, cam-operated from the main drive.

Chip deflectors, attached to the saddle housing, direct the chips to the skirt surrounding the cutter. The central column carrying this skirt is provided with a circular floor of steep pitch. The completed gears, oil, and chips slide down the chute so formed into a pan where they are separated.

Magazines, loading nose-pieces, and arbors are made for each individual job.

Loading of the magazine is facilitated by the use of a loading bar on which the blanks are assembled. This bar is inserted, with the blanks locked on it, at the top of the magazine. By releasing a clamp screw the gears are dropped into the magazine. About twenty gear blanks are carried in each magazine. The machine is provided with change gears to vary the cutter speed from 50 to 520 ft. per min. Cutting speeds can also be varied to suit material being handled.

SPECIFICATIONS

CAPACITY

Largest pitch	3 d.p.
Diameter of cutter head	20.8 in.
Largest pitch diameter that can be cut	4 in.
Greatest pitch angle	65 deg.
Smallest pitch angle	25 deg.
Minimum and maximum number of teeth to be cut	6 to 30

WORK SPINDLE

Diameter taper hole large end	1.796 in.
Taper per foot	0.500 in.
Diameter of hole through	1¼ in.

SPEEDS AND FEEDS

Speed of cutter head, r.p.m. from	21.2 to 95.5
Speed of cutter head, f.p.m.	50 to 520
Horse power of motor	10
Floor space	85 x 103 in.
Net weight (lb.)	12,000

"Handy Andy" Electric Hoist

A low-headroom electric hoist, known as the "Handy Andy," has been placed on the market by the Handy Hoist Company, 847 West 120th St., Chicago, Ill. The hoist is simple and compact in design and weighs only 160 lb. It is 24 in. in length and 7½ in. in diameter. The lifting capacities are 500, 1,000 and 1,500 lb. It is fully-inclosed, all working parts being encased in a heavy cast frame or housing. However, the entire gear mechanism, as well as the drum type switch, may be

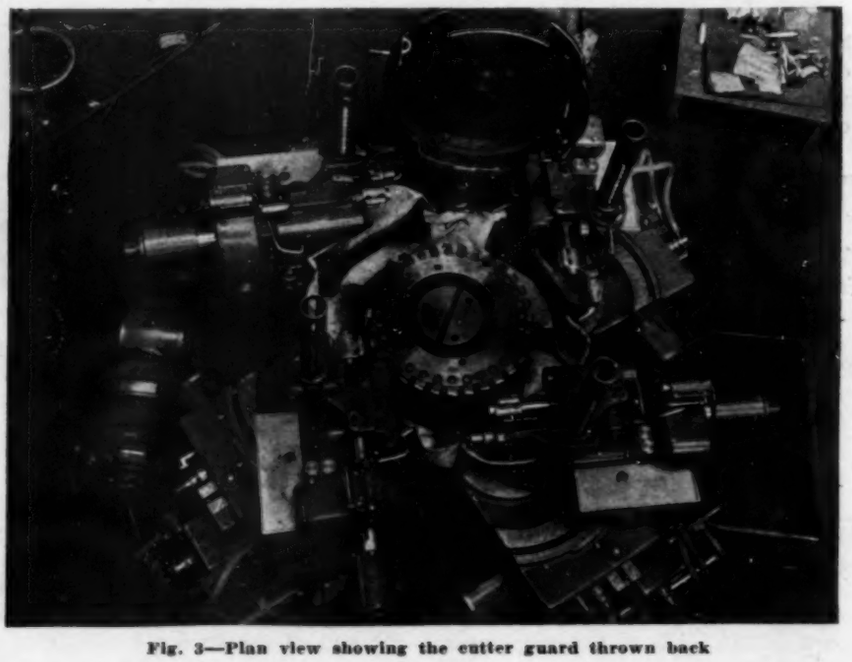


Fig. 3—Plan view showing the cutter guard thrown back

taken out easily by removing the end plate. The motor may also be removed easily without disturbing the wiring.

The gears used are machine cut and heat-treated. All shafts are machined and ground and the parts are interchangeable. The drive shaft, pinion, and motor shaft are integral. The main shaft runs on ball bearings, each of which has a complete self-lubricating system with oil reservoirs. A fan for cooling the motor is also mounted on the shaft.

The hoist is equipped with a 110-volt, universal motor with cord and plug for operation from any lamp socket. Standard equipment also includes a 12-ft. length of load chain with hook at one end. The hoist has

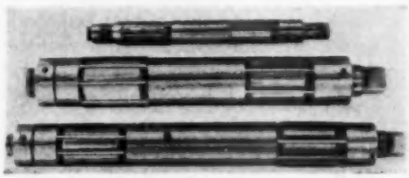
"Handy Andy" Electric Hoist

positive mechanical load control and with the brake engaging at the same time the switch is thrown into neutral, thereby preventing either coasting or slipping of the load.

Foster Johnson Reamers for Railroad Motion Work

Three tools, illustrated below, for railroad motion work have been brought out by the Foster Johnson Reamer Company, Elkhart, Ind. These reamers have been designed to ream accurately the bronze bushings in valve cross heads, and Walschaert and Baker valve gear frames. Each tool is double-bladed and the expansion or contraction of both sets of blades is controlled by one graduated adjusting nut. This feature makes it possible to ream two holes in line and the same size in one operation.

The reamer is contracted so that the front set of blades will pass



Foster Johnson Reamers for Railroad Motion Work

through the first hole and the reamer is then expanded in this position and both holes reamed at the same time. Each tool has a large range of adjustment which permits reaming the holes to any desired size and also allows for regrinding the blades.

Whiting Electric Locomotive Mover

The Whiting Corporation, Harvey, Ill., has developed the electric locomotive mover, shown in illustration, designed to save time and labor in moving dead engines, to lessen repair time, and reduce locomotive dead time. Modern locomotives are too heavy to move with pinch bars, while the use of hot engines not only ties up the hot locomotive, but also impedes the turntable service in the roundhouse and the work of the transfer table in the back shop. The use of a winch is cumbersome.

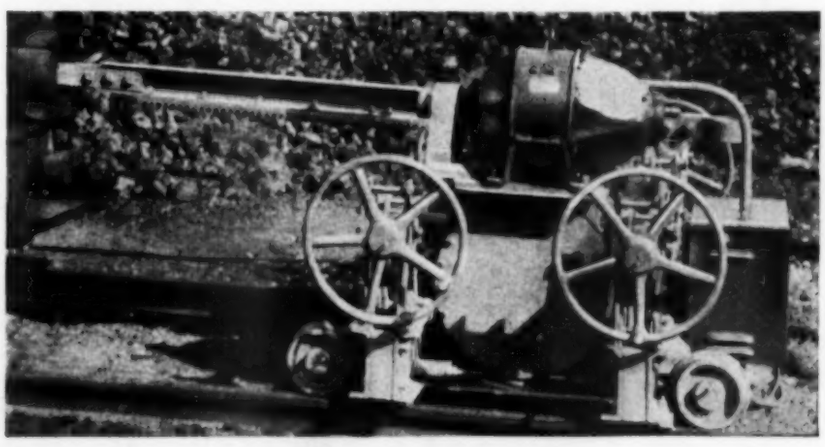
This patented machine consists of a steel structure 3 ft. in height mounted on four flanged wheels equipped with roller bearings, the wheels spaced for standard gage track. The entire truck is less than 5 ft. in length and can be easily moved by one man. The mover can be lifted from track to track with a crane by an eye in the center of the top.

A 5-hp. motor mounted on the truck drives a horizontal beam through a series of gears at a rate of 5 ft. per minute with ample power to push or pull any locomotive from the smallest type to the heaviest Mallet. The beam is furnished in any length required. A special coupler fitted at either end of the beam may be attached to either the knuckle pin or the draw bar pin of the dead engine. When the beam is in its normal position, its coupler height is that of A.R.A. requirements. The beam is adjustable, by means of regulating springs, to any desired coupler height.

When a locomotive is to be moved, the mover is first locked to the rails by means of the clamps, one for each wheel, gripping beneath the ball of the rail and drawing the truck frame downward until its serrated steel blocks grip the top of the rail. The handwheels, two on either side of the truck, work the clamping mechanism.

The motor, operated by push-button control, pushes or pulls the beam to the engine and connection is made with coupler or draw bar. After coupling on, the operator stands beside the locomotive and controls the spotting as the locomotive is pulled or pushed along. Precise control makes it possible to spot the engine accurately.

If, at the end of the beam's travel a greater movement is desired, the mover is released from its anchorage



Whiting Electric Locomotive Mover

and re-anchored again where desired with the beam still attached to the engine. After the locomotive is spotted the beam is released and moved back to its mid-position on the truck, the electric cable is disconnected from its wall receptacle, and the locking mechanism released.

Applications of the locomotive mover include: Spotting for drop-pit table work; locating front and back dead centers in setting valves; running engines over for squaring up valves; getting crank pins on bottom quarter for applying and removing side rods; spotting front wheels and crosshead for application and removal of wrist pin (crosshead pin); spotting shop engines to relieve interference; placing locomotives under smoke jacks, and connecting the locomotive tender to its locomotive.

Peerless Vertical Heavy-Duty Metal Sawing Machine

INTENDED for cutting large bars and billets, a 14 by 16-in. vertical, heavy-duty, metal-sawing machine has been placed on the market by the Peerless Machine Company, 1615 Racine St., Racine, Wis. Large bars and billets can be carried and put into the machine from an electric crane or otherwise. The blade operates up and down while it is being forced into the work, instead of being operated across the top of the work, while being forced downward. The vertical position of the blade enables a powerful stream of cooling solution to be applied at the top of the cut, which is of assistance in forcing out the chips at the bottom of the cut. The blade relieves itself automatically on the non-cutting stroke, and at the conclusion of the cut, the machine is tripped out automatically after which the saw frame carrying the blade returns to the starting position and stops.

There is a roller arrangement built into each side of the work table, so that, when a large bar or billet is placed thereon, the operator by the use of a handle can raise the piece of work up, where it will remain until he rolls it to the point to be cut, and then by lowering the handle the stock is rested on the table. Each of the front vise jaws is arranged with hardened steel serrations to insure against the stock moving out of position. The construction of the machine is heavy and rigid, and its weight of 4,500 lb. permits the use of a heavy saw blade.

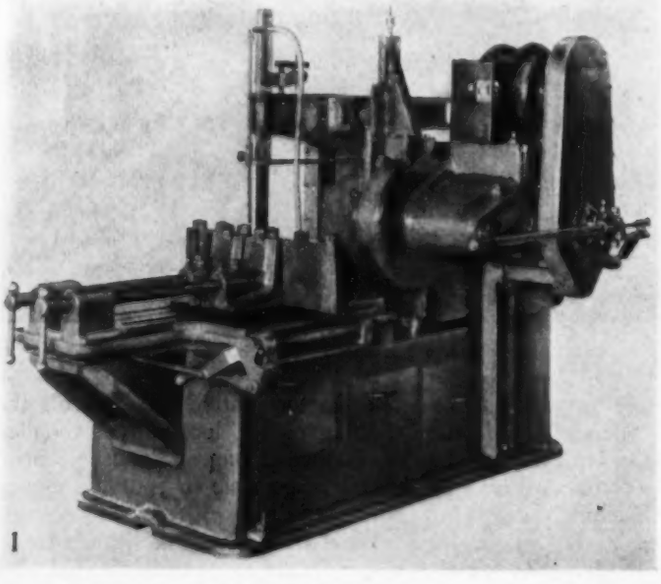
The feeding arrangement includes both a positive and a compensating feed, with the positive feed provided with a safety feature to prevent the blade from breaking when it becomes dull. This feature makes for economy, inasmuch as the saw blade can be reground before damaged irreparably.

The machine is arranged with ball bearings throughout and the transmission runs entirely in oil. Three speeds are available. Chain drive is used. The machine can be set to trip out at any given distance within its capacity, and is arranged to use saw blades from 17 to 24 in. in length. An instruction plate is attached to the machine, which indicates the proper feed pressure for the various classes and diameters of work. A graduated feed pressure slide bar is set according to the chart. The cooling solution used is a common soluble oil mixed with about 20 parts of water to one part of soluble oil.

The space required is approximately as follows: Length 10 ft., height 4 ft. 9 in., width 4 ft. 4 in. The weight, as stated previously, is 4,500 pounds.

Cross Gear Tooth Rounder

The gear tooth rounder illustrated has been placed on the market by the Cross Gear & Engine Company, 3250 Bellevue Ave., Detroit, Mich. The machine consists of a cutter head and spindle mounted on a 45-deg. head, and actuated by a feed cam located in the column of machine. The cam action is transferred to the cutter spindle through a rack and pinion. Travel of $\frac{3}{4}$ in.



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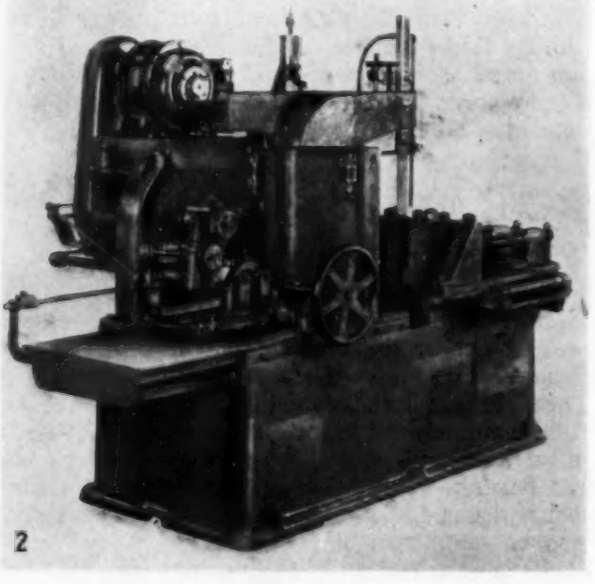

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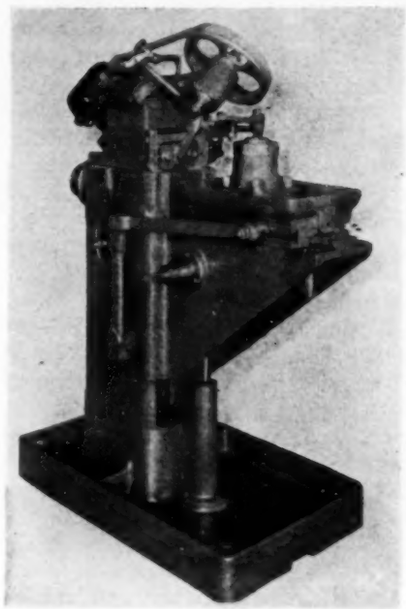
Fig. 1—Peerless Vertical Heavy-Duty Metal-Sawing Machine from the operating position. Fig. 2—Opposite end of the machine



Cross Gear Tooth Rounder

on the 45-deg. head takes care of varying pitches and gives sufficient clearance to withdraw the cutter from the work during the indexing operations.

Instead of supporting the cutter head on gibs and ways, hardened and ground ball races have been provided, and the races are adjustable, so that all play can be taken out of the head. The cutter spindle is mounted on ball bearings, and two types of cutters can be used, a formed cutter mounted on a draw-in stub arbor, or a Woodruff-key-type cutter held in a collet. The cutter is driven by an electric motor on the rear of the machine, the feed being through a worm gear and clutch, all mounted in the column of the machine.

The clutch operates the table action only, and through this medium the mechanism is stopped or started for loading and unloading. Indexing is done from the already formed tooth and the gear is held rigidly right at the point of the cut during the cutting operation. The chamfering on the teeth is the same all the way around and there are no uneven teeth where the lands are wider on one side than the other. Provisions are made for adjusting the cutter in relation to the work and the work in relation to the sector.

Lubrication of cams and all interior parts is through a force pump located in the column. The sub-base has a capacity for 2 gal. of oil.

The productive speed of the gear tooth rounder is 50 teeth per min. on standard types of auto starter gears, and it has capacity for 2-in. pitch diameter gears to 36-in. pitch diameter gears of 6 D.P. The machine is sturdily constructed to minimize vibration.

Gallmeyer & Livingston No. 3 Surface Grinder

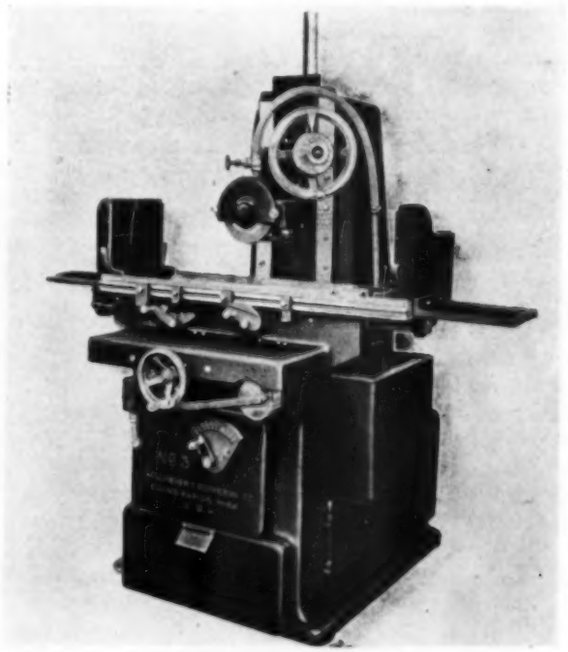
THE No. 3 surface grinder built by the Gallmeyer & Livingston Company, Grand Rapids, Mich., has an automatic table travel of 26 in. longitudinally and 9 in. transversely. The working surface of the table is 8x24 in., and the vertical movement of the wheel head is 11 in. From the table to the circumference of an 8-in. diam. wheel the distance is 10 inches.

A Brown & Sharpe oil pump furnishes the hydraulic power for the longitudinal feed. A control lever on the front of the machine regulates the valve on the hydraulic feed and varies the feed from approximately 55 down to 5 ft. per min., the reduced speeds being obtained through bypassing almost all of the hydraulic oil around the operating valve. The intake and outlet pipes of the oil system are sealed to prevent the entrance of dirt.

A small lever, operated by stops set at the required points on the table, regulates the travel and reverse of the table in a longitudinal direction. This lever is shown at the right in the photograph. The small lever at the left starts and stops the machine.

The mechanical cross feed operates through a worm and gear drive with internal and external ratchets. Feeds are from 0.004 in. to $\frac{1}{8}$ in. Adjustment is made on the lever mechanism shown below the table.

To raise and lower the wheel head over considerable distances the large handwheel is used. This handwheel turns the elevating screw through a worm and worm-gear. It is graduated in quarter-thousandths of an inch, with a moveable pointer which can be set for convenient reading. For fine adjustments a smaller wheel is provided, with a back-geared action to the elevating mechanism. Both wheels in this case turn and the graduations on the small wheel moving over the pointer give adjustments in increments of ten-thousandths of an inch.



Gallmeyer & Livingston No. 3 Surface Grinder

A one-piece casting forming the base and column of the machine gives rigidity and makes accurate work possible. The ways for the head have a V-gib to adjust for wear. Those on the crossfeed are V-ways, while the table has a V-way at the front and a flat way at the back.

The hydraulic gear is mounted on a bracket so that it can be removed by taking off a coverplate. A bronze bearing 7 in. long is installed in the front of the head and a ball bearing in the rear. Adjustable telescoped

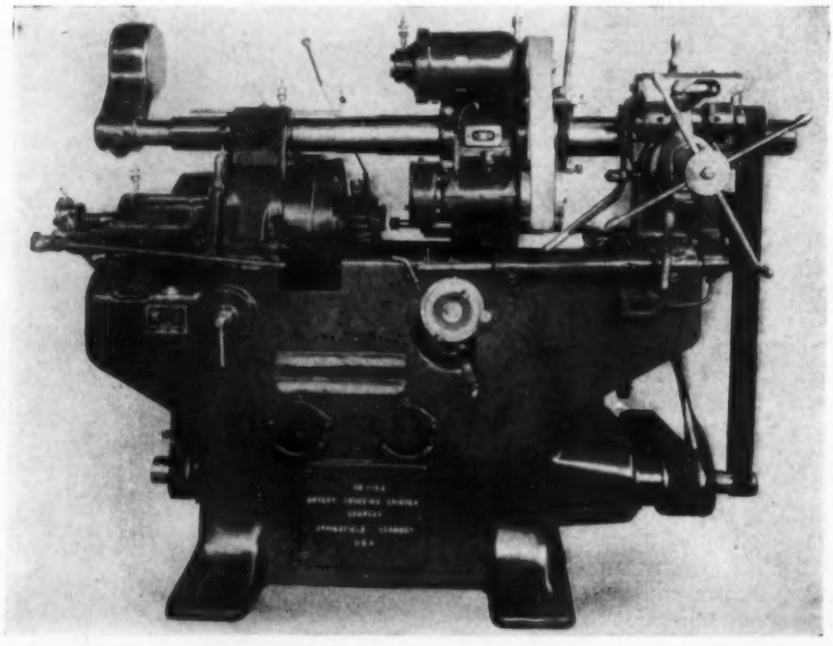
guards enclose the front of the head.

The grinder is driven by a 5-hp. motor driving a belt held in tension by an idler jack. The motor is mounted on a bracket in the base of the machine, at the back. An automatic control switch protects the motor should the machine be overloaded.

A magnetic chuck and controller can be provided, if desired, at extra cost. Wet-grinding guards come with the machine. By the use of fixtures the grinder can handle angle work.

Bryant No. 12 Semi-Automatic Hole Grinder

HAVING a maximum grinding length of 9 in. and a total chuck swing of 16 in., the No. 12 hole grinder has been placed on the market by the Bryant Chucking Grinder Company, Springfield, Vermont. An 11-in. maximum stroke is provided. The model illustrated is the No. 12A which in addition to grinding the hole also grinds the face of the work. An extra facing wheel is provided for this purpose.



Bryant No. 12A Hole and Face Grinder with self-contained motor drive

The machine is entirely self-contained. The wheel spindle is driven by a single belt from the 3,600 r.p.m., 7½-hp. motor mounted directly on the wheel slide, an idler being provided to give maximum belt contact and ample adjustment. A second motor, a 1,200 r.p.m., 2-hp. size, is mounted on the back of the machine and drives the main drive shaft, from which power is taken for the work spindle, longitudinal traverse, power feed, and pump. The work is driven from a cone pulley at the left end of the main shaft. Two work speeds, 200 and 400 r.p.m., are available, the change from one to the other being made easily.

The wheel slide swings automatically to the rear, giving easy access to the chuck. Traverse is by a gear bracket, an intermediate shaft with pinion engaging a circular rack. Power feed is obtained from a cam on the traverse shaft, and it is adjustable.

An automatic clutch starts and stops the work as the wheel enters and leaves. Traverse and pump drives, as well as the motor, are by belt from the right end of main-shaft. The wheel slide is suspended from a cylinder in adjustable boxes to permit cross feed and longitudinal traverse in the same bearings. Provision is made for the use of a sizing device and a wide variety of quick-acting chucks are available.

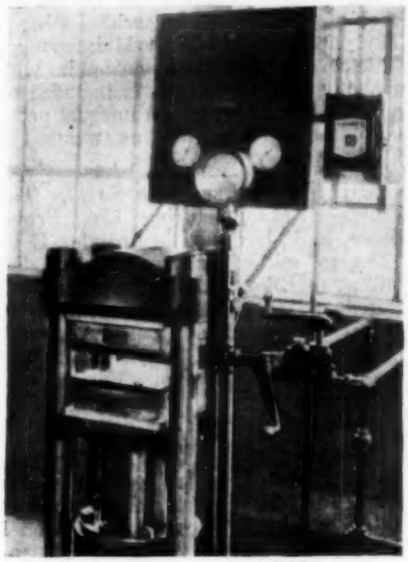
Specifications: Total chuck swing 16 in.; maximum wheel-slide traverse, 11 in.; maximum grinding length, 9 in.; wheel slide travel per revolution of work, $\frac{1}{16}$ to $\frac{1}{2}$ in.; floor space required 3½x7½ ft.; net weight of machine with motors, 2,950 pounds.

The standard outfit consists of one standard size wheelhead, lever arrangement for operating chucks, an assortment of grinding wheels, diamond holder and diamond, power cross feed, water pump and connections, water guard for chuck, belt guards, suitable wrenches, and motor brackets. A variety of chucks, especially designed to meet requirements of accurate and quick chucking of gears, ball and roller bearing rings, collars, bushings, cylinders, connecting rods, can be furnished.

Trent Electrically-Heated Molding Platens

Temperatures that may be varied up to 600 or even 800 deg. F. may be obtained on the electrically-heated platens developed for molding plastic resinous compounds by the Harold E. Trent Company, 439-43 North 12th St., Philadelphia, Pa. On such platens it is easier to make the necessary heating connection than to steam-heated platens, because electrical connections can be made very flexible and are more dependable in operation. The platens, which have renewable ground surfaces, can be made up to 40 in. square, and the temperature varied for molding the various types of compounds. The heating element is designed to have a low temperature gradient, thus assuring long life and ease of control.

Presses can be fitted with two platens per press, or three, or any required number, although three is the usual practice. The temperature of each platen can be controlled separately by means of a gage on each, or the control bulb can be placed in one platen and control, in addition, the temperature of the other platens in the same press. As the connection from the bulb to the gage is of flexible steel, whether the control is put in the moving platen or the fixed platen is of minor importance. The illus-



Typical Trent Electrically-Heated Molding Platen Equipment with temperature control on each platen. The temperature limit is 800 deg. Fahrenheit.

tration shows a typical platen equipment with the temperature control on each platen.

These electrically heated platens can be arranged for single-, two-, or three-phase circuits as occasion demands, and still obtain balanced load conditions.

No-Ox-Id Protective Wrapper

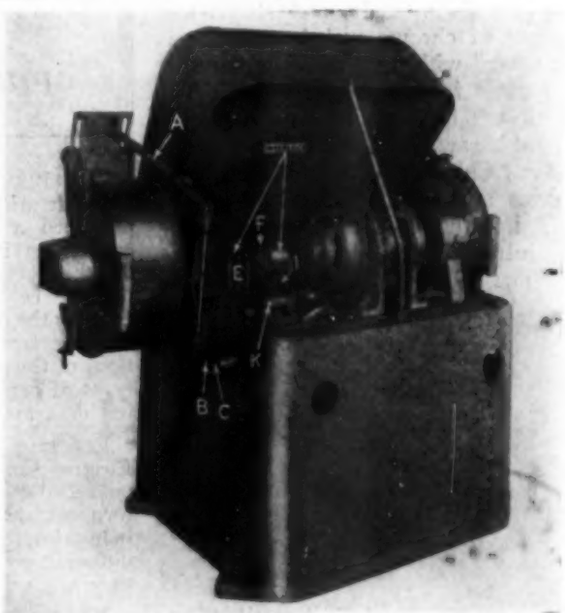
A wrapper designed to protect finished surfaces between operations, and also for service as a wrapper to protect the finished product in shipment is being manufactured by the Dearborn Chemical Company, 310 S. Michigan Ave., Chicago, Ill. The wrapper is used in conjunction with No-Ox-Id Rust Preventive, a brushed-on preparation for preventing rust. The No-Ox-Id wrapper is produced of a fabric impregnated with No-Ox-Id of a different type than the one used for coating. This fabric may be wrapped around the surfaces over the coating of No-Ox-Id, and will conform to various contours. The adhesive nature of the wrapper will cause it to make a joint moistureproof enough to withstand rain or water under ordinary conditions, an ability which is enhanced by the regular No-Ox-Id coating beneath. The wrapper is gray in color and may be obtained in rolls of convenient size. The consistency of No-Ox-Id recommended for this work is known as "G Special." It will brush readily at ordinary temperatures, and is of sufficient consistency to build up a substantial thickness of film of long-wearing properties.

Safety "Rite-Speed" Heavy-Duty Grinders

BY MEANS of a safety interlock between the wheel diameter and the spindle speed on "Rite-Speed" grinders, manufactured by the Safety Grinding Wheel & Machine Company, Springfield, Ohio, it is possible to increase the grinding wheel speed as the wheel wears away and thus maintain normal grinding conditions, while at the same time using a normal size constant-speed motor. A number of such changes can be made during the life of the wheel, depending upon the original size of the wheel and the user's wishes. Thus on a 30-in. wheel, changes may be arranged for at 26, 22, 18, and 14 in. in diameter or at 24, 18 and 12 inches. Likewise, if a 24-in. wheel is used, changes may be made at 20, 16, and 12 in. in diameter or at 18, and 12 inches. A standard ball-bearing a.c. motor is used, and, because of the wheel-speed changing device, the power factor may be maintained at the highest possible figure.

Referring to the illustration, the interlock device consists of a lever *A* suitably connected to the shutter in the standard hood equipment. As the wheel wears away, the shutter is lowered, which rotates *C* through arm *B*, which in turn moves the cam *E* pivoted in block *K*. Cam *E* is provided with a depression, in which the point of switch *F* operates. As long as the point is in this depression, the motor may be started, but when it is raised out of the depression the motor cannot be started except by unusual and extreme methods. Switch *F* is mounted on arm *I* which is connected to motor frame. Clamps hold the motor, with slides maintaining the chain tension and alignment in all positions for the different spindle speeds. Sprockets not in use are placed near the drive.

As the hood shutter is lowered the cam *E* is moved upward. When the limit of the depression is reached the cam *E* opens switch *F*, which makes the automatic starter inoperable, and it is impossible to run the machine until the proper sprocket, corresponding to wheel diameter, is mounted on the motor spindle. When the proper sprocket has been mounted on the motor, switch *F* will be in proper position with relation to cam *E* to permit operation of the machine from the main operating push-button station on the front. This cycle of operations occurs with each change of speed until the wheel is entirely worn out.



Safety "Rite-Speed" Heavy-Duty Grinding Machine from the rear, showing the safety speed interlock

In addition to bringing the wheel speed up to the correct amount, this method also insures against overspeed. It is necessary to raise the shutter of the grinding wheel hood when a new, or full-sized, wheel is to be mounted, which causes cam *E* to rotate to its maximum downward

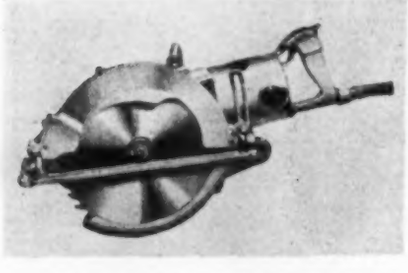
position. Switch *F* will then be opened and prevent running the machine until the proper motor sprocket has been applied to give the safe and correct speed, corresponding to grinding wheel diameter.

The machine is adaptable for wheels of organic bond or for vitrified wheels. The machine is built in four sizes, having distance between wheels of 55, 55, 48, and 48 in., respectively, wheel sizes of 30x3 in., 24x4 in., 20x3 in. and 16x3 in., respectively. The smallest wheel diameter for clear grinding is 12, 11½, 10½, and 10½ in., respectively. The floor space required by the largest machine, with hoods, is 48x50 in., and the weight is 2,800 pounds. Motor size depends upon requirements, ranging from 7½ to 15 hp. for the largest size.

Skilsaw Model R Heavy-Duty Electric Saw

Like the smaller models manufactured by the company, this large Model R heavy-duty "Skilsaw" has an aluminum body, and shafts and gears of chrome nickel steel. It is powered with a universal motor that operates from any light socket. The unit has been placed on the market by Skilsaw, Inc., 3814 Ravenswood Ave., Chicago, Ill. The 12-in. blade gives a maximum cutting depth of 4⅝ in., the base of the saw being adjustable to the depth of cut.

The Model R is provided with an



Skilsaw Model R Heavy-Duty Electric Saw

improved swivel foot for beveling with a degree gage and is fitted with a safety guard, which protects the operator regardless of the position of the saw or the type of cut being made. The unit can be changed into a bench or table saw by simply turning it upside down, no further adjustment being necessary. Besides cutting and ripping heavy lumber, the Skilsaw cuts metal up to 20 gage, copper cable, lead pipe, and, when fitted with a carborundum disk, will also cut stone and composition.

Standard equipment includes one combination rip and cut-off saw blade, an adjustable rip fence attachment, rubber-covered cord with turn-and-lock attachment plug, a high-pressure grease gun and a socket wrench—all contained in a handy carrying case with the saw itself.

"National" Wall Chart of Drill and Tap Sizes

A wall chart covering decimal equivalents, tap drill sizes, and hints for twist drill users has been published by the National Twist Drill & Tool Company, Detroit, Mich. The chart is made in three folds for convenience and contains information which should be of interest to all shop mechanics and draftsmen.

TRADE PUBLICATIONS

COG BELTS. The Dayton Rubber Manufacturing Co., Dayton, Ohio, has published a very large and complete catalog on its cog belt drives, listing all the standardized drives, including the cog belts and pulleys, and giving data for the calculation of special drives. A large section is devoted to illustrations of the drives as applied to various types of machinery. Various engineering data are included.

ELECTRIC FURNACES. The General Electric Co., Schenectady, N. Y., has published catalog GEA-1146 on electric furnaces, showing their uses in various industries for the production of many different products. The advantages of their use are cited.

ELECTRIC TOOLS. The Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y., has published catalog No. 897 on the complete line of "Hicycle" portable electric tools. The products described are drills, grinders, motor generator sets, nut runners, reamers, sanders, screwdrivers, stud setters and tappers. Specifications are listed. Many views are given of the uses of the tools. The catalog contains 64 11x8½-in. pages.

LATHES. The Monarch Machine Tool Co., Sidney, Ohio, has published a booklet entitled "Monarch Lathes—Their Installation—Their Maintenance" which illustrates almost every point with a photograph. A chapter is included on questions and answers on unusual problems. The bulletin contains twenty 11x8½-in. pages.

MILLING CUTTERS AND SAWS. The Thurston Manufacturing Co., Providence, R. I., has published catalog G on "Thurco" milling cutters, saws and die-milling machines. Each product is illustrated and specifications are listed, together with available sizes. A section is devoted to die milling machines and the tools for use thereon. Various useful engineering data are appended. Catalog contains 82, 7½x5-in. pages.

NICKEL CAST IRON. The International Nickel Co., Inc., 67 Wall St., New York, N. Y., has published a bulletin entitled "Nickel Cast Iron—Theory and Practice." It contains ten studies of the effects produced by the use of nickel cast iron and illustrates the type of product for which each different quality is desired.

STAMPS. The Pittsburgh Stamp Co., 811-817 Canal St., Pittsburgh, Pa., has published a catalog on "Thor" steel letters and figures. A list of the sizes of the stamp itself and the size of the characters is presented.

WRENCHES. Stevens Walden-Worcester, Inc., Worcester, Mass., has published a catalog and price list of various types of wrenches, including socket sets, "boxtite" wrenches, hand-type nut setters, valve stem wrench sets, automobile wrench sets, and steel toolboxes.

VISES, EFFICIENCY OF. The U. S. Department of Commerce, Bureau of Standards, has published research paper No. 91 on the results of an investigation undertaken to determine the relationship between the size of the vise and its efficiency by performing typical shop operations on material held in the vise. The bulletin, which is replete with graphs illustrating the various test results, may be obtained from the Superintendent of Documents, U. S. Printing Office, Washington, D. C., for 10 cents.

WORKMEN'S SAFETY COMMITTEES. The Metropolitan Life Insurance Co., Policyholders Service Bureau, 1 Madison Ave., New York, N. Y., has published report No. 5 in an industrial safety series, entitled "Workmen's Safety Committees." The leaflets in the series are based upon studies of successful accident prevention work undertaken by modern industrial establishments. The workmen's safety committees as dealt with in the report have proven an excellent medium through which responsibility for aiding in the prevention of accidents can be delegated to certain selected employees.

NEWS
OF THE WEEK

Recent Show May Aid in Averting Recession Evident in Other Industries

AS A result of the recent Machine Tool Show, it seems likely that the industry will not have a business recession in the next few months proportional to that which is becoming evident in other industries, according to Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association. While the fourth quarter prospects for merchandising and distributing interests are good, business is acting "tired," much as it did in the spring of 1927, at the end of the 1926 wave. Various business indexes for August reflected a decline in general business. Information now available foreshadows further recession through September general business which will be shown when Fall figures are in.

Quite a number of industries indicated over-production in their August figures. Steel operations declined perceptibly during September, a month when ordinarily there is considerable expansion. Automobile producers are making strong efforts to stimulate the demand for new cars, but it seems reasonable to believe that the edge of the public appetite for motor cars is becoming dulled.

Seasonal factors in current business added to present large demands for stock-market credit, will certainly prevent much easing of money rates during the rest of this year. The present monetary situation places a burden on the industry that needs to raise capital through borrowing, and it also places a burden on the countries whose purchasing power is to a considerable extent dependent on foreign exchange rates. This situation is unfavorable to business expansion, and business expansion generally has cut a large figure in the demand for machine tools.

The labor supply of the machine-tool industry has continued decidedly poor. Many more deliveries could be made if skilled workmen were available to produce the tools on order. The industry itself, by the manufacture of more high-production machinery, is doing its share to relieve the tension resulting from the machinist labor situation all over the country. The weakening in prices of scrap, finished steel, and pig iron, and the declining backlogs of the material-producing concerns suggest a cautious buying policy for a while. There is plenty of fuel available at the present time.

The index of machine-tool orders still indicates the recession which has been evident during the past several months. The index for the past month is 265.8, as compared with 286.1 for August, 294.8 for July, and 236.8 for September, 1928.

* * *

Engineering Laboratory Planned for Detroit

An engineering laboratory for display and practical demonstration of industrial machinery under working conditions will be established soon in Detroit under the sponsorship of MacDonald Bros., Inc., of Boston and New York. The establishment is planned to be a national proving ground for competing lines of machinery, and is expected to keep abreast of modern mechanical engineering and invention and to bring together, under one roof, improved mechanical equipment sought for by national industrialists.

The laboratories are planned to contain permanent exhibits of equipment by representative manufacturers, presenting the various features of equipment under actual working conditions. In addition to the displays of the various companies, there will be branch offices and sales representatives in constant attendance. All visitors to the laboratory will be registered, and a force of engineers will be maintained to assist industry. The corporation which has been formed to back the enterprise is called the MacDonald Bros. Engineering Laboratories, Inc., of Massachusetts.

* * * *

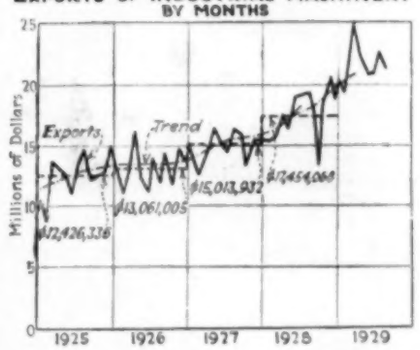
Upward Movement in American Machinery Exports Checked Slightly During August

THE upward movement in exports of American industrial machinery evident during the previous few months was interrupted in August, according to L. J. Cochrane of the Industrial Machinery Division, U. S. Department of Commerce. Foreign shipments fell by 8 per cent under those of July, although they were still 19 per cent more than those of August, 1928. This may be regarded, however, as a trade fluctuation and has only current significance since returns at the end of August showed that foreign sales of American industrial machinery for the first eight months of 1929 totaled more than $173,000,000 and exceeded those for the same period of 1928 by 25 per cent.

Of the various principal classes of machinery, exports of power generating, metal-working, textile, sewing, and shoe machinery during August were somewhat less than those during the corresponding month of 1928, but gains made earlier in the year placed the total for all of these items for the first eight months of 1929 well in advance of the volume reached during the corresponding period of 1928. In the case of construction, conveying and pumping machinery, sales made during August, 1929, as well as during the eight months ending with August, show a large increase over those of corresponding periods of 1928.

Foreign sales of metal-working machinery during August were 12 per cent less than those in August, 1928. Previous gains, however, more than compensated for this decline and sales for the first eight months of 1929 totaled more than $27,000,000, or 28 per cent more than those of last year. While most of the important items in this group showed gains, the increase

EXPORTS OF INDUSTRIAL MACHINERY BY MONTHS



in foreign sales of lathes, internal grinding machines, sheet and plate metal-working machines, forging machinery, rolling-mill machinery, foundry and molding equipment, pneumatic portable tools, drills and reamers, was particularly notable. In some lines, however, business fell off. This was particularly true of vertical drilling

machines and external cylindrical grinding machines.

Of the remaining machinery lines, sales of paper and pulp mill machinery, wood-working machinery, blower and ventilating machinery, refrigerating equipment, ball and roller bearings, air compressors, and laundry and dry cleaning equipment all showed outstanding increases during the first eight months of 1929, as compared with those of the same period of last year. On the other hand, business has fallen off considerably for bakery machinery and parts, sugar mill machinery, grinding and slicing machinery.

* * * *

Volume of Metal-Working Operations More than that of Last Year

THE general volume of operations in the metal-working industry during September was slightly greater than that during the same month last year, according to data received by *Electrical World* on the consumption of electrical energy by a large number of these plants scattered throughout the country. The September rate of activity in the metal-working industry, after corrections are made for the number of working days, was 6.5 per cent more than that of August and 0.8 per cent more than that of September last year. September, 1928, had the high rate of operations for the year, so that even an 0.8 per cent gain is an indication of the high rate of activity which is being maintained by the metal-working plants.

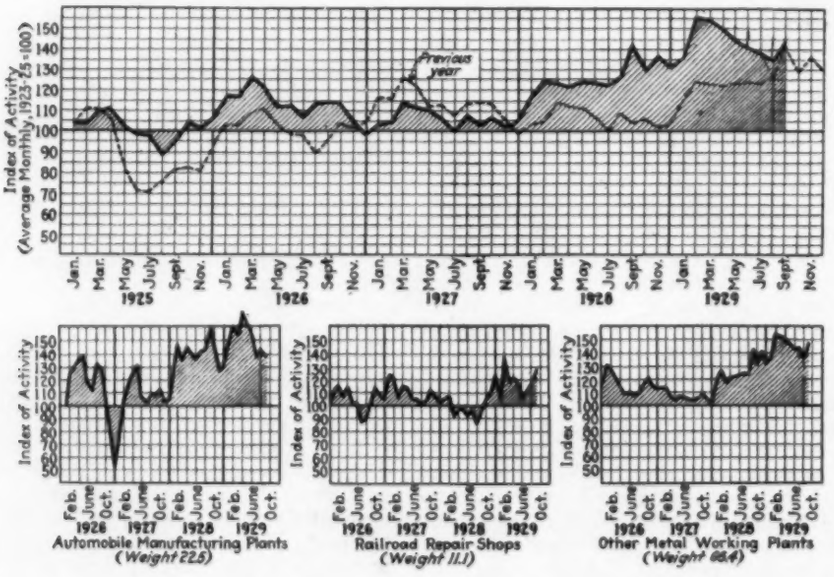
The automobile manufacturers, including the manufacturers of parts and accessories, reported a decrease in the rate of operations during September of 3.4 per cent, as compared with that of August. Current September operations were about 14.2 per cent more than those of the same month last year. This figure is not so surprising when it is remembered that the rate of operations during September, 1928, was the highest recorded during the year. It appears probable that the automobile manufacturing industry will continue to decrease its operations as the year unfolds.

Quite a different picture is presented by the other branches of the metal-working industry. The September rate of operations outside the automobile plants was 9.5 per cent more than that of August and 2.2 more than that of September last year. Here again, September, 1928, witnessed the peak of activities for the year. The volume of operations in these plants, it now appears, will remain on a comparatively high plane during the remainder of the year. Activity in the railroad repair shops during September was 10.6 per cent more than that of August, and 40 per cent more than that of September last year.

* * *

Railroads Handle Huge Traffic in Eight Months

Class 1 railroads in the first eight months of 1929 handled the greatest volume of freight traffic on record for any corresponding period, according to reports for that period just received by the Bureau of Railway Economics. Freight traffic for the first eight months of 1929 totaled 325,388,114,000 net ton miles, an increase of 11,030,634,000 net ton miles, or 3.5 per cent over the previous high record for any corresponding period established in the eight months of 1927. It was an increase of 6.5 per cent above the traffic for the corresponding eight months of 1928.


Index of Activity (Average Monthly 1923-25=100)
Previous year
Jan. Mar. May July Sept. Nov.
1925 1926 1927 1928 1929
Index of Activity
Feb. June Oct.
1926 1927 1928 1929
Automobile Manufacturing Plants (Weight 22.5)
Railroad Repair Shops (Weight 11.1)
Other Metal Working Plants (Weight 66.4)

Army Demonstrates Mechanized Equipment

Nearly 10,000 members and guests of the Army Ordnance Association, the National Metal Trades Association, and the National Aeronautic Association attended the field demonstration of mechanized war equipment at the Aberdeen Proving Grounds, Aberdeen, Md., on Oct. 10. The all-day field demonstration is an annual event sponsored by the Army Ordnance Association with the active participation of the seven branches of the regular, organized army. This year's feature was an exhibition of the increasing mechanization of the fighting forces, particularly the new Christie tank, having a speed of 60 miles per hour, and the self-propelled heavy artillery. There was also a demonstration of a battery of 75-mm. anti-aircraft guns, firing from a central electric control, with automatic leveling and sighting of the guns by means of torque amplifiers.

The annual field meeting of the Army Ordnance Association is for the purpose of demonstrating to American manufacturers and engineers, upon whom the design and production of munitions will fall in wartime, the complex requirements of ordnance for a large field army.

Lt. Col. George S. Brady, associate editor of the *American Machinist*, was a visitor at the demonstration. For the past two weeks he has been taking special training at the War Department as one of the two Army Ordnance officers selected to attend this year.

* * *

Tungsten Electric Buys Four Product Plants

A consolidation of the leading manufacturers of tungsten and molybdenum products for the electrical-equipment industry was revealed recently in the statement announcing the organization of the Tungsten Electric Corporation, incorporated under the laws of Delaware. The company has acquired the business and assets, including properties, patent rights, trade marks, and good will of the Callite Products Co., Inc.; Independent Contact Manufacturing Co., Inc.; International Wire Co., Inc., and the Precision Metal Products Co., all of Union City, N. J.

* * *

Four Companies Enter Motors Radio Corporation

Full details of a new partnership which has been formed by General Motors Corporation with the Radio Corporation of America, the General Electric Co., and the Westinghouse Electric & Manufacturing Co., were announced recently with the statement that General Motors was entering the radio manufacturing business in "a large way." Under this alliance these companies, having total assets of about $2,000,000,000, are linked together in

what is regarded as one of the most ambitious radio enterprises of the kind started in recent years. Joint operations of the four companies will be conducted through a new subsidiary, the General Motors Radio Corporation, in which General Motors will have a 51 per cent stock interest. The General Motors Radio Corporation's capital stock will consist of $10,000,000 preferred stock and 1,000,000 shares of no par common. General Motors will have full management of the company, directing its operations through a separate executive personnel. R. J. Emmert will be president of the new corporation.

* * * *

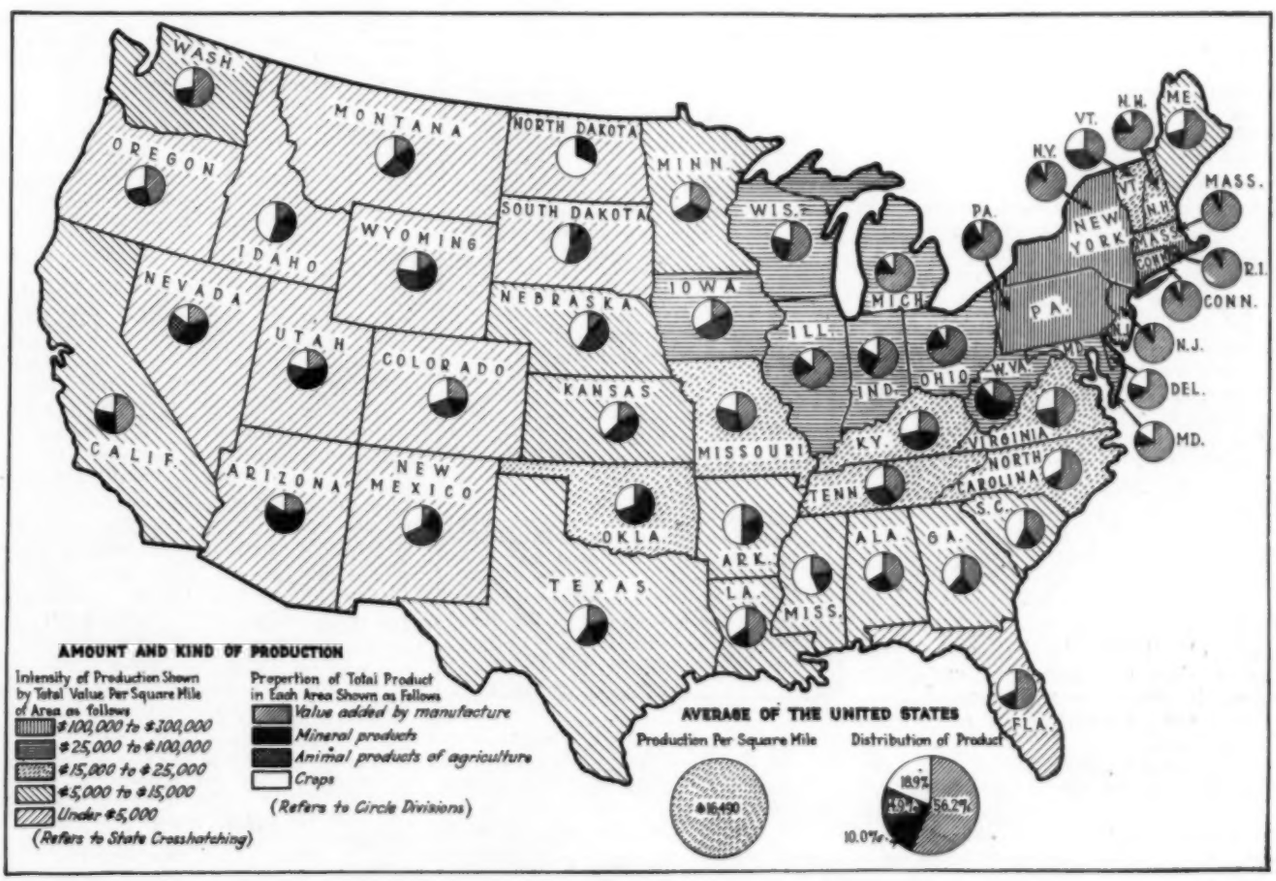
U. S. Manufacturing Adds More Than Half To Total Production of Wealth

MORE than half of the total production of wealth in the United States is added by manufacturing, according to a recent study by the National Industrial Conference Board. The value added by manufacture comprises 56.2 per cent of the total distribution of product, while crops contribute but 18.9 per cent, animal products of agriculture, 14.9 per cent, and mineral products, 10 per cent of the total. Production per square mile for the entire United States averaged $16,490 in value.

A striking picturization of the proportion of total products in various areas of the United States and also of the intensity of production is shown in the accompanying chart, which indicates where the annual wealth of the United States is produced and what the distinctive contributions of the different states are. In this chart the annual product of agriculture, mining, and manufactures is related to the area in which it is produced. By stating the aggregate product in terms of square miles, the measure of comparability between the different sections is established. The intensity of production obviously depends upon the natural resources of the different regions and upon the number of persons occupied in production. Areas of relatively intense production are in the main areas of dense population.

The character of each state's contribution to the aggregate differs greatly. East of the Mississippi River, manufacturing and mining, combined, outweigh agriculture in the northern sections, except in Vermont. In the South Atlantic States, except in South Carolina and Georgia, the same is true, while in the East South Central section Alabama alone shows this preponderance of combined mining and manufacturing. Such a preponderance is found also west of the Mississippi in Louisiana, Oklahoma, Utah, Nevada, Arizona, California, and Washington. In most of the states of the East South Central section, in all of the states in the North West Central section and in other states West of the Mississippi which have not been specifically mentioned, agriculture predominates. Mineral products alone are more important than either agriculture or manufactures in West Virginia, Oklahoma, Utah, Nevada, and Arizona.

In the chart, the term "value added by manufacture" is the value created by the manufacturing processes, calculated by deducting the cost of materials and supplies, fuel and power, from the value of products. Data are for 1927. "Mineral products" include non-metallic minerals as well as metals. In general, the values used pertain to the first marketable form in which the minerals are produced, and duplications are eliminated. Data on mineral products are also for 1927. "Animal Products of Agriculture" include animals raised, bee products, dairy products, poultry products, wool, and other like products. Data are for 1926. "Crops" are taken at gross value, that is to say, crops fed to livestock are included. Data are for 1926. "Value per square mile" is computed on the basis of the aggregate value in the four fields of activity specified, per square mile of land area. Information for the chart was received from the United States Department of Agriculture, Bureau of the Census, and the Bureau of Mines of the U. S. Department of Commerce.



BUSINESS BAROMETER

Crisis in business considered past, as drops in stock market tend to stabilize conditions and improve the outlook

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

WHEN his temperature commences to fall, a man who has been suffering from a high fever becomes apathetic and lethargic. The change generally indicates that the crisis is passed, and to the trained eye it is encouraging, although the depression of the invalid may be great.

These pathological observations are prompted by the behavior of the stock market last week. Call money was apparently easier, but security prices are, upon the whole, lower, and the enthusiasm of the "bulls" is manifestly chilled. Whether it can be revived or not is a question that time alone will answer, but most of those who are carrying stocks on margin seem more disposed to sell than to buy, and a magnetic personality will be required to lead the army of speculators up to the heights at which prices ruled some months ago.

Not a few of these speculators feel that a successful "return from Elba" has rarely been achieved, and for this reason they are disposed to take the profits they have left on firm markets. This policy seems to be a wise one to pursue, and should be given careful consideration by all those who view the situation from the speculative standpoint.

Of course, it will be said that a decline in the stock market need not necessarily depress business if earnings and dividends are not impaired, but there are two sides to this question, and as bearing upon the other side, the following letter from a prominent American investor who is now abroad may be of interest: "I think there is a defect in the argument that business can continue as at present if the bull movement ceases—in shares. It is based on the assumed continuance of employment and production. But employment and production are controlled by the purchasing power of the public. And just as the purchasing power of the public withers in a long bear market for shares, commodities, and realty, so does it expand in a prolonged bull movement in these things.

"So long as a man can pay for his winter clothes, or a new car, by buying 'any old thing,' the business of the tailor shop and garage is certain to flourish. But, once this resource is cut off, is not the certain result a recession in business?

"Even if steel holds at 225 and Atchison at 280, and even if every laborer is kept employed as at present (however problematical these things may be) must not business slacken when a man must pay for his clothes—and a new car—out of an income that is not swollen by profits from share speculation?

"In other words, if we ignore the consequences of great losses certain to be suffered some day by speculators through the depreciation in value of their holdings, and if we could assume that every wage-earner might remain at work at high wages, and that no dividends now paid would be passed or reduced, must we not recognize that some slack in trade is inevitable?"

There is, however, but little to encourage the belief that we face any general recession in business. In one or two lines there are indications that the demand is not, perhaps, as exigent as it was, but it is absurd to argue that American prosperity depends upon the constant presence of the plus sign in all business statistics, and it is quite natural that a period of brief quietude should now follow the intense activity that was reported last summer.

In its effort to feel the pulse beat of business, the stock market is giving most of its attention to the steel trade, and the conjunction of decreasing mill activity and declining prices is the theme of occasional bearish outgivings. The weakness of the steel markets is traceable to the automobile industry, which one of the trade reviews says "is passing through the morning after a production jag." At any rate shipments of steel to the motor manufacturers are the smallest in eighteen months, and most observers are reconciled to the idea that the fourth quarter output of automobiles will be relatively small. But there is no valid reason for pessimism in these facts.

Wheat has been rather easy under the congestion of spot supplies that still exist. Rubber statistics are bearish and recent price gains have been lost. Most of the other commodities are featureless. The price-trend as a whole is still slightly downward.

The commercial money markets are stabilized, while rates on security loans have declined. However, brokers' loans in New York advanced again last week to within $5,000,000 of the record made two weeks earlier. Permanently easier money is not to be expected unless there is a more pronounced business recession than now seems probable.

Upon the whole, the outlook is encouraging, but caution is advisable, as the crowd is becoming psychologically hypersensitive to bad news, and is prone to interpret the unfavorable in terms of pessimism.

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From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

IMPROVEMENT has been rather general in the machinery and machine-tool industry during the past week. With the exception of Cleveland, which reports general apathy, and Detroit, where employment is low and orders have fallen off as a result of the curtailment of automotive production, inquiries sent out during and immediately after the Show at Cleveland are beginning to materialize into orders. The restrained condition of the market still exists, however, and orders are mainly for single tools, largely for replacement. Prices have not changed, although there is a tendency to increase them because of backlogs. Deliveries are spotty, having improved in some cases and fallen off in others, while the great majority remain about as they were. Used tools are still going well, when modern tools are available.

NEW ENGLAND reports limited improvement, and activity in the airplane and drop-forging industries. Cincinnati demand is growing steadily, but is largely for single tools. Milwaukee reports a diversified demand, and a variety of industries interested. New York buyers of consequence for the week are Western Electric, General Electric, and Amtorg. Philadelphia automobile equipment and radio manufacturers are buying, and railroad electrification is proceeding rapidly.

CHICAGO reports that the Norfolk & Western has a list of 50 items out, and that used tool demand is brisk. Buffalo conditions are getting better, with Rochester, N. Y., the busiest city in the district.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine-tool business

THE following reports, gathered from the various machinery and machine-tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CHICAGO

Improved conditions in the machine-tool market are reported generally. The improvement consists not so much in bookings as in the increasing number of inquiries that have been coming in since the Cleveland exposition. These are of a character that affords ground for the belief that the Machine Tool Show has undoubtedly stimulated interest in standard shop equipment, particularly such as has been either newly invented or greatly improved. Railroad inquiry, with one exception, still is mostly limited to small lots. The exception is the Norfolk & Western, which has come into the market with a list comprising some 50 items, the larger number of which are for use in the company's shops. The Chicago Board of Education has just sent out an inquiry for several standard tools and a number of shop accessories, desired for use in the Harper Junior High School addition and in a branch of Crane Technical High School. The Western Electric Co. continues as one of the leading buyers of certain lines of equipment. Industrialists and machine-shop operators in the Chicago area and in nearby states are given credit for the larger share of present buying. Demand for used tools continues brisk. A slight improvement in deliveries is reported.

NEW YORK

Market conditions in the machinery and machine-tool industry showed but little change during the past week in the New York district. In several instances, October is expected to bring 50 per cent more business than the preceding month, but, in the main, the increase will not be so large. The Amtorg Trading Corporation, American purchaser of machinery and machine tools for Soviet Russia, is buying equipment steadily. The company placed an unusually large number of orders during the past week. The conditions under which these orders were granted remain substantially as they have been, with part cash on signing of the order, and the remainder in regular payments.

Deliveries have not changed for the better, except in a few isolated cases. Several well-known lines, on the contrary, are quoting deliveries that are considerably poorer than they have been. Prices have not been changed during the week, but price changes are expected in several lines as a result of continued accumulation of backlogs. The used tool market demand is continuing, but the shortage of good tools is as evident as it was.

General Electric, Western Electric, and several aviation firms were the large buyers of the week, beside Amtorg. Orders continue from isolated sources, many of them companies, such as paper plants a paper cup plant, and similar organizations, which are not expected to purchase machine tools. Orders, in most cases, are for single tools. Inquiries, however, are creating a noticeable amount of optimism. The large number of inquiries which resulted from the Cleveland Show is still increasing, with many of the inquiries bidding fair to materialize into orders in the near future.

CINCINNATI

While sales are at a lower level than they were a month ago, demand is growing steadily, and a better market is developing, according to reports of machine-tool manufacturers of the Cincinnati district. Orders coming in, together with those previously booked, are keeping plants busy, and there is no thought of reducing production. Selling agents report that the demand in local and adjacent territory is gradually returning to normal. It is thought that, directly and indirectly, the machine-tool industry will be helped by the fact that more than $100,000,000 is about to be spent in the city for major building operations which among other things include a new railroad terminal and a 40-story building that will occupy half of a block.

The past week's business was largely made up of sales of single tools to general machinists and other small users, the buyers being located in all sections of the country. Likewise, the great majority of the week's inquiries came from general machinists and other small users, whose requirements were single tools.

PHILADELPHIA

Machinery and machine-tool dealers and producers in the Philadelphia market reported business to be up to expectations during the last two weeks, with a slight falling off in orders in some cases. Inquiries have been in fair volume from a well-scattered area, and are indicative of some early orders.

The last two weeks were marked with activity in several industrial lines, including oil refineries, power plants, and the general metal trades. Some purchases were made by automobile producers and some by the radio industry. Producers of scientific instruments for plant equipment reported a brisk business during the last month, with August and September the best months of the year. Orders placed included drills, cutters, reamers, shapers, lathes, and general shop equipment. Railroad buying continues to be slight.

The Pennsylvania and the Reading Railroads are proceeding rapidly with their preliminary plans for extensive electrification of suburban lines, with eventual extension of the improvement to New York and Washington. Public work generally is progressing, particularly in subway construction. Airport activities continue, with indications of early acquisition of a tract near Philadelphia for the development of a flying center.

CLEVELAND

The general apathy to buying that was so prevalent previous to the Machine Tool Show remains unchanged. To date, the much expected resumption of buying has failed to materialize. No visible signs of improvements in sales were noted in the last ten days. Orders have been limited to one and two pieces to diversified lines. A goodly number of inquiries are on hand and sales representatives are bringing more pressure to bear on live prospects in order to close.

According to a local dealer, the unemployment situation in the Detroit automobile industry is causing some concern. Local auto parts manufacturers are inclined to look at this condition with a pessmistic eye for the future, and this naturally reflects on the tool builder.

Producers are gradually catching up with production and better deliveries are in the making. Automatic machine business is holding up with the average amount of new business. The demand for punches and shears is better than for some time past. Planer manufacturers are enjoying good business. An encouraging sign for improvement is seen in the increase in the number of new industrial construction expansions.

BUFFALO

While there are some who do not expect to see the volume of business this fall that was experienced in the spring, conditions are definitely on the rise at the present time in the machine-tool field. The Show is undoubtedly responsible for many of the inquiries now in the hands of dealers. It is probable that a high percentage of them will prove to be of no immediate value. But it is true that a great many will also result in orders which might not have been obtained otherwise.

The electrical equipment business is following that of machine tools. Sales representatives report that there is a large volume of small orders but practically no large orders and no one industry outstanding in its purchases. Metal furniture industries in Jamestown, N. Y., have been making some important purchases of presses, but, aside from these, the demand in Jamestown industry is slow at present. Demand is said to be relatively more active in Rochester, N. Y., at the present time than in any other industrial community in the Buffalo area.

MILWAUKEE

Last summer's peak figures in the machine-tool trade are being neared with a revival of buying coincident with the close of the Cleveland show. Pending business is being closed rapidly and nearly all of the inquiries originating in the last three months are reported to be bearing fruit. Demand is widely diversified and cannot be said to be weak in any department of the metal trades. Delivery dates have not been advanced, and back logs show signs of increasing.

Although agricultural implement manufacturers are entering their dull period, they are, nevertheless, preparing for the coming season by the addition of new equipment. Elaborate and extensive selling campaigns are being launched by large Milwaukee manufacturers of tractors, contractors' equipment, and excavating machinery following consolidations and concentration of manufacturing in these lines. While automobile production is not expected to reach the high mark of any recent year, the manufacturers are prosperous and are replacing worn-out machinery. Changes of equipment are being made because of sweeping changes in the design of their product.

Some cautious prophets point to a slump in orders from the custom pattern shops as an indication of some midwinter depression. This suggestion is not accepted by others in the trade, who argue that the growing tendency towards standardization of products naturally restricts changes in patterns once the matter of new design has been settled.

Even the woodworking machine producers are actively engaged in plant expansion. Purchase of $250,000 worth of new machine tools and other shop equipment, authorized by the board of directors of the Yates American Machine Co., Beloit, Wis.,

has barely been started. Most of this allotment is to be spent for replacements and in expansion of the plant at Beloit, with a liberal allowance, however, for the factories at Rochester, N. Y., and Hamilton, Ontario.

NEW ENGLAND

Machine-tool sales in the New England section during the current week, while rather limited as a whole, showed a distinct improvement over those of the previous week. Inquiry for heavy equipment gives indications of early improvement in this line. Small tool sales held to a satisfactory level, and continue to be a feature in New England trading. Certain industrial centers showed a more pronounced market for used machinery, with orders for several lathes, a shaper, milling machinery, bench tools, and drills.

The aeronautical industry is a fertile one for future business. Activity at New Haven, Bridgeport, Milford, and East Hartford, Conn.; East Boston, Waltham, Agawam, and Lowell, Mass.; Warren, and Pawtucket, R. I., is exceptionally promising. The Pratt & Whitney Aircraft Co. has closed on new contracts covering 350 airplane engines and parts, representing $2,500,000 of business.

Drop-forging plants are busy, and expansions are being planned. Industry, in most manufacturing lines, is at close to top speed, with orders in sufficient numbers to assure steady activity into the new year. A revival of the high market level which has characterized the industry most of the year is anticipated in Connecticut and Massachusetts industrial centers. Executives are encouraged by the reception given the introduction of improved standard machine tools at the Show. Foreign prospects are being established and, it is expected, will bring a heavy volume of new business.

DETROIT

Within the past ten days a slight upward trend has become apparent in the sales of machinery and machine tools, and, though there is no early prospect of important developments, it is nevertheless felt here that the next two months will be fairly productive.

The past few weeks have been unusually dull in Detroit and in all of the other large cities of Michigan. Sales of machinery and equipment have not reached the mark expected by the dealers. The summer months were far below the average set in the first five months of the year and it was generally predicted, here, that the fall would be another prosperous period. Now the dealers are becoming reconciled to the fact that the totals for the year will be lower than 1928. The autumn has been a disappointing one and only a few dealers report good sales.

Within the past few days a number of important sales have been made in the field of heavy machinery. Two of the large automobile manufacturers are making extensive adjustments which involve good-sized purchases and a few other deals are in prospect.

A number of dealers are making sales to the small shops doing contract jobbing work and there is evidence that these sales are the forerunners of important deals. The work done in these shops usually precedes the work of adjusting and re-equipping the large plants when changes are made in car and motor designs and the like.

General business conditions here are very poor. Unemployment is increasing and the prospects of a hard winter are becoming more and more apparent. Unless the sales of cars and the consequent speeding up of production increase earlier than usual after the holidays, Detroit business will suffer.

* * * *

Older Man in Industry is Subject of Association Meeting

ASPIRITED discussion followed the reading of several papers and reports on the subject "The Older Employee in Industry" at one of the general meetings of the annual convention of the National Association of Manufacturers, held in New York on Oct. 14, 15, and 16. John E. Edgerton, president of the association, enunciated the keynote of the meeting when he said extemporaneously, in response to heckling: "Because he becomes an employee, a man is none the less a human being. Humanitarianism, justice and good business, all these demand that every employee be treated with kindly consideration and fairness. The employer is far more keenly and truly interested in his men and women than any social agitator."

In the absence of Charles K. Seymour, chairman of the employment relations committee, Noel Sargent, manager of the association's industrial relationship department, read the annual committee report. The report was a discussion of the Southern textile labor disturbances without conclusions, of labor turnover and blanket pay changes. According to the report labor turnover is on the decline, being about one-half of what it was ten years ago, and blanket reductions and raises are uneconomical and unfair.

In a special report which followed it was said, "The exclusion of older men by industry has been exaggerated. Investigated, 72 per cent have no hiring age limit. Of 28 per cent who do, none discharge at any fixed age. All feel the obligation to hold older men on the job as long as their physical condition permits, and to care for them after their retirement."

Other speakers at the meeting were: Roderic M. Olzendam of the Metropolitan Life Insurance Co.; William J. Graham, of the Equitable Life Assurance Society; and P. Tecumseh Sherman, of the National Civic Federation.

As an unprogrammed surprise, Millicent Pond, employment supervisor of the Scoville Manufacturing Co. which employs more than 6,000 men, defended the justice of hiring-age limits when operated sanely, justly, and with exceptions. Mr. Sargent read letters from two unnamed corporations which together employ 75,000 men, in which the same limits were defended.

* * *

BRASS pipe nipples are the subject of a recent Commercial Standard, published by the U. S. Bureau of Standards. The Standard is an effort at elimination of waste through simplified commercial practice.

Italy Increases Metal-Workers' Wages

BY OUR PARIS CORRESPONDENT

An agreement regulating the wages of workers in the metal-transforming industries in Italy has just been entered into, affecting the city and province of Milan, and intended to be applicable throughout north Italy.

The points covered by the agreement are the fixing of minimum wages, the rate of payment for special work performed at night, and a derogation or tolerance which permits a certain number of workers to be employed at less than the minimum wage. Consideration is given the relation of living costs to the minimum wage.

The minimum wage of the metal worker in concerns situated outside the city limits vary from 2 lire to 3.05 lire per hour for men, from 1.20 to 1.40 lire for apprentices, and 1.05 to 1.30 lire for women. In dollars and cents, the scale works out from $.054 to $.115 per hour. In the city of Monza, the minimum wage varies from 2.10 lire to 3.20 lire for men, 1.25 lire to 1.45 lire for apprentices, and from 1.10 lire to 1.35 lire for women while that of children is fixed at 75 centisimi.

Business Items

Gears & Forgings, Inc., Cleveland, Ohio, has purchased a plant at 2108-2120 North Natchez Ave., Chicago, for the Gauschow division of the company. The plant consists of two units, of one-story, daylight, monitor-type, construction, consisting of approximately 35,000 sq.ft. of manufacturing space. Exterior is face brick and terra cotta. The interior will be floored with wood block. Division offices will be located on the second floor, and the Chicago branch office will be moved to the plant. William Gauschow will continue as manager and second vice-president of the company. G. F. Goedke, Chicago, district sales manager, will move his offices from 1001 Washington Blvd. to the plant. An addition of 8,000 sq.ft. is being contemplated.

Officials of the Acme Machine Products Co., a Michigan corporation, have filed papers with the secretary of state in Indianapolis, changing the state office and agent to Earl A. Munger, 500 West Willard St., Muncie, Indiana.

The Eclipse Interchangeable Counterbore Co., Detroit, moved recently into a new factory and office building at 7410-30 St. Aubin Ave. The building is two stories in height, 65x120 ft. and costs, with additional equipment, $150,000. Seventy additional men will be employed.

Construction of the new factory of Fairchild Aircraft, Ltd., at Longueuil near Montreal, Que., has been commenced, and completion is expected about Dec. 15. The company owns 265

acres of land on the St. Lawrence River there, and is constructing a breakwater 750 ft. long. The capacity of the plant will be about five aeroplanes a week.

The Logangear Co., Toledo, Ohio, has purchased the Indianapolis Tool & Manufacturing Co., Indianapolis, and will move the plant to Toledo in the near future.

The Apollo Magneto Corporation, Kingston, N. Y., has bought the assets, goodwill, and patents of the Automatic Motor Control Corporation, New York. The plant and equipment will be moved to Kingston.

The Troy Engine & Machine Co., Troy, Pa., has bought the business and equipment of the Engberg Electrical & Mechanical Works, St. Joseph, Mich., but the plant will not be moved to Troy until later.

The Active Machine & Tool Co., Cleveland, has changed its name to Tools & Gages, Inc. Officers have not been changed.

The Racine Tool & Machine Co., Racine, Wis., has purchased the plant of the Davies Shoe Manufacturing Co., Racine, and will transfer its plant immediately.

L. A. Benson & Co., Baltimore, have been appointed distributors for the Diamond Chain & Manufacturing Co., Indianapolis.

The Bantam Ball Bearing Co., South Bend, Ind., has added a brass foundry to the plant. C. O. Hiler is in charge.

Personals

A. W. BERRESFORD, president of the American Engineering Council, who for many years was prominently identified with the electrical industry, has been named managing director of the National Electrical Manufacturers' Association, to succeed Alfred E. Waller, resigned. He is a past president of the A.I.E.E., and a member of the A.S.M.E., the Society for the Promotion of Engineering Education, and of other technical associations.

L. B. GREEN, formerly development engineer of the Borden Co., Warren, Ohio, has become works manager of the Globe Machine & Stamping Co., Cleveland.

J. V. HYDE, formerly manager of Boeing Field, Seattle, Wash., has been appointed aeronautical inspector with the aeronautical branch of the Department of Commerce.

ALBERT SHEPHERD, formerly foundry superintendent of the Advance Rumely Co., LaPorte, Ind., at the Battle Creek, Mich., plant, resigned recently to become foundry superintendent of the Star Foundry Co., Troy, Ohio, in which he has an interest.

JOHN ECKERLE, president of Aluminum Industries, Inc., announced that he will devote his activities solely to the automotive field upon his return from Europe recently. At the same time vice-president and general sales manager F. J. Glennon, announced the appointment of ROBERT E. MCGILL and EDWARD R. BRAZEL as western manager and district manager, respectively, with headquarters at the company's branch in San Francisco.

FRANCIS P. GORMELY, vice-president and general manager of the Haynes Stellite Co., Kokomo, Ind., has been appointed vice-president and general manager of the Union Carbide Co., and the Electro Metallurgical Co. J. H. MAGUIRE, formerly superintendent, becomes works manager of the Kokomo company. Other promotions are as follows: sales manager, E. E. LeVan; plant superintendent, F. T. McCurdy.

C. E. RUTH, formerly of the engineering department, Rust Engineering Co., Pittsburgh, has been appointed district sales manager in northern Pennsylvania, Ohio, western New York, and Ontario for the Homestead Valve Manufacturing Co., Inc., Coraopolis, Pennsylvania.

A. C. MATHIESON, formerly chief draftsman of the Automotive Air Brake Co., Pittsburgh, has joined the Bendix Brake Co., South Bend, Indiana.

J. W. GARDNER, chairman of the board of directors of the Gardner-Denver Co., Quincy, Ill., has returned from a trip to Europe. While abroad he visited points of interest in England, Norway, Sweden, and France.

A. J. SCHMITZ has been established in Portland, Ore., by the Allis-Chalmers Manufacturing Company, as representative in the Portland territory. Mr. Schmitz came to Portland from Havana, Cuba, where he represented the company for eight years.

FRANKLIN T. KURT, formerly sales manager and field engineer of the Bourdon Aircraft Corporation, Hillsgrove, R. I., is now a member of the engineering department of the Viking Flying Boat Co., New Haven, Connecticut.

E. F. TERRY, chief engineer of the Denver, Colo., plant of the Gardner-Denver Co., Quincy, Ill., returned recently from a trip to the principal cities of South Africa and Europe.

R. B. POGUE, of the American Brake Shoe & Foundry Co., New York, has been appointed assistant chief engineer. He has been connected with the company for the past 10 years.

WALTER C. ALLAN, president of the Yale & Towne Manufacturing Co., Stamford, Conn., has been elected a director of the Western Electric Company.

REX J. L. DUTTERER has been appointed mechanical engineer for the Defiance Spark Plugs, Inc., Toledo.

JOHN K. NORTHROP is the designer of a new type of monoplane employing all-metal construction with smooth sheet-metal covering which will be produced by the Northrop Aircraft Co., in a factory to be erected at the United Airport, Los Angeles, in the near future.

REX H. DYER, Kansas City, Mo., is the inventor of a pipe-line electrical welding machine which is claimed to be able to weld two sections of 12-in. pipe in 10 seconds.

ALEXANDER F. JENKINS, president and treasurer of the Alexander Milburn Co., Baltimore, sailed for Europe on Oct. 12 for a stay of indefinite duration.

REX B. BEISEL has been appointed vice-president and chief engineer of the Spartan Aircraft Co., Tulsa, Oklahoma.

GEORGE M. DEMOREST has been appointed district representative for Pittsburgh and vicinity by the Palmer-Bee Co., Detroit.

ERWIN J. MOHR has been appointed manager of industrial sales of the Gunite Corporation, Rockford, Ill.

Obituaries

ERNEST F. HARDER, assistant to the vice-president of the Westinghouse Electric & Manufacturing Co., died on Oct. 13 of pneumonia at his home in East Orange, N. J. He was 72 years of age, and came to this country from Germany at the age of 25 to enter the employ of the Westinghouse company, at Pittsburgh, as a foreman.

HOWARD SELLERS, formerly a director in the machine-tool firm of William Sellers & Co., Philadelphia, died at his home in Wynnewood on Oct. 14. He was born in Philadelphia in 1857, and was graduated from the University of Pennsylvania in 1877.

HENRY J. HILL, 70, retired metal manufacturer, died recently in Newark, New Jersey.

Forthcoming Meetings

AMERICAN IRON AND STEEL INSTITUTE—Meeting of members. Hotel Commodore, New York City, Oct. 25.

SOCIETY OF INDUSTRIAL ENGINEERS. Sixteenth national convention at Hotel Statler, Cleveland, October 23 to 25. Requests for programs should be sent to S.I.E. national office, 205 West Wacker Drive, Chicago.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION. Semi-annual fall meeting at the Benjamin Franklin Hotel, Philadelphia, October 24 to 26. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS — Annual meeting, New York, Dec. 2 to 6. Headquarters will be at 29 W. 39th St., New York City. Calvin W. Rice is secretary.

THE WEEKLY PRICE GUIDE . . .

Rise and Fall of the Market

BUYING of steel by railroads, although fairly active, is not sufficiently great in volume to offset the present decline in demand for automotive material. Steel prices are weakening, as are those of scrap and pig iron. Antimony, scrap brass and zinc tend downward; tin is higher than a week ago; while most of the other non-ferrous metals remain unchanged. The present unsettled condition of the Chinese antimony market is expected to cause a reversal in the movement of prices.

(All prices as of Oct. 18, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$17.69@$18.19
Northern Basic	19.90
Southern Ohio No. 2	19.90
NEW YORK—Tidewater Delivery	
No. 2 Southern (silicon 1.75@2.25)	19.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	14.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.26@21.76
Virginia No. 2	24.04
Basic	19.75@20.25
CHICAGO	
No. 2 Foundry, local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	20.01
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20.26
Basic	20.26
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.35	3.30	3.90†
No. 12	2.15@2.25	3.45	3.35	3.95†
No. 14	2.25@2.35	3.55	3.45	4.00†
No. 16	2.35@2.45	3.65	3.55	4.10†
Black				
Nos. 18 to 20	2.65	3.85	3.70	3.80
No. 22	2.80	4.00	3.85	3.95
No. 24	2.85	4.05	3.90	4.00
No. 26	2.95	4.15	4.00	4.10
No. 28	3.10	4.75	4.15	4.25
Galvanized				
No. 10	2.80@2.90	4.20	4.05	4.05
Nos. 12 to 14	2.90@3.00	4.30	4.15	4.15
No. 16	3.00@3.10	4.40	4.25	4.25
No. 18	3.15@3.25	4.55	4.40	4.40
No. 20	3.30@3.40	4.70	4.60	4.55
No. 22	3.35@3.45	4.75	4.65	4.60
No. 24	3.50@3.60	4.90	4.75	4.75
No. 26	3.75@3.85	5.15	5.00	5.00
No. 28	4.00@4.10	5.40	5.25	5.25

*Light plates. †Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt	53.74%	41.2%	55.5%	43.5%	55.5%	42.5%
3½ to 6 in. lap	50.32%	37.78%	53.5%	40.5%	51.6%	39.0%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches External	Diameter in Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28
8	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Decimal Fractions	B.w.g. and	Outside Diameter in Inches ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.60	3.65	3.60
Cold drawn, flat or square‡	4.10	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.25	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse— $\frac{3}{32}$, 8.35c. per lb.; $\frac{1}{8}$, 7.85c. per lb.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			48.00@49.00
Lead, pigs, E. St. Louis	6.70	New York	7.62½@8.12½
Zinc, slabs, E. St. Louis	6.75@6.80	New York	7.75@8.25

	New York	Cleveland	Chicago
Antimony, slabs	10.50@11.00	11.50	14.50
Copper sheets, base	27.75	27.75	27.75
Copper wire, mill, base	20.12½	20.12½	20.12½
Copper, drawn, round, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25@26	24.30	24.30
Zinc sheets (casks).....	10.75@11.25	11.70	10.11
Solder (½ and ½).....	32.00	32.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			60.00
Commercial genuine, intermediate grade.....			43.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt.....			12.00

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold drawn.....	53.00	40.00
Tubing	75.00*	90.00†
Angles, not rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	15.50 @15.75	13.50	13.00 @14.00
Copper, heavy, and wire..	14 75 @15.75	13.00	12.00 @13.00
Copper, light, and bottoms	12.75 @13.50	12.50	11.00 @12.00
Heavy lead.....	5.50 @ 5.75	6.25	4.75 @ 5.25
Tea lead.....	4.00 @ 4.25	4.25	3.75 @ 4.25
Brass, heavy, yellow.....	8.25 @ 8.75	8.00	8.00 @ 8.50
Brass, heavy, red.....	12.00 @12.50	12.50	11.75 @12.25
Brass, light.....	7.00 @ 7.50	7.50	7.00 @ 7.50
No. 1 yellow rod turnings.	9.50 @10.00	9.00	9.00 @ 9.50
Zinc.....	3.00 @ 3.50	3.25	3.00 @ 3.25

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb..	$0.13*	$0.16	$0.15
Cotton waste, colored, per lb..	.09½*	.12	.12
Wiping cloths, washed, white, per lb.....	.12½	38.00 per M	.16
Sal soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.171	.174	.171
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.75	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.24
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*Grade F.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.033	$0.0325
Cold drawn shafting...	per lb..	.036	.036	.034
Brass rods.....	per lb..	.2125	.2125	.175
Solder (½ and ½).....	per lb..	.32	.33	.3425
Cotton waste, white...	per lb..	.13	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	4.60	3.60	3.59
Lard cutting oil.....	per gal.	.75	.75	.65
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*.....	$5.94	$5.94	$5.94
Emery cloth*.....	26.40	26.40	26.40
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†.....	2.65	2.61	2.61
Cloth†.....	4.60	4.59	4.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton.....	Connellsville, 2.65@2.75		
Coke, prompt foundry, per net ton.....	Connellsville, 3.75@4.85		
White lead, dry or in oil...	100 lb. kegs....	New York, 13.75	
Red lead, dry.....	100 lb. kegs....	New York, 13.75	
Red lead, in oil.....	100 lb. kegs....	New York, 15.25	

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, ½-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal, will receive bids until Nov. 1 for metal working and grinding machines, also drill press vises.

Md., Baltimore—M. Charost & Co., 127 Siegel St., Brooklyn, N. Y., machinery and equipment for the manufacture of a complete line of living-room furniture for recently acquired building at Eagle and Monroe Sts.

Mass., Boston—Bureau of Supplies & Accounts, Navy Dept., Washington, D. C., will receive bids until Oct. 29, for balancing machines, lathes, engraving machines at Navy Yard, here.

Mass., Boston—David Caplin Co., 68 Harrison Ave.—4 ft. gear dinker, 4 in. stroke.

Mass., Boston—Duplicate Parts Co., 48 Binford St.—16 or 18 in. lathe.

Mass., Boston—Electric Maintenance Co., 127 Purchase St.—engine lathe 18 in. x 6 ft. compound rest.

Mass., Boston—Merrimac Oil Burners, 123 Merrimac St.—three spindle drills, capping attachments and electric drills.

Mich., Detroit—Aircraft Display Case Co., 300 East Jefferson Ave.—equipment for the manufacture of display cases for proposed 2 story, 140 x 265 ft. factory. Estimated cost $95,000.

Mich., Detroit—Hayes Body Corp., 551 Seventh St. N. W., Grand Rapids—machinery and equipment for manufacture of metal bodies for automobiles for proposed factory on Muskegon St. Estimated cost $260,000.

Mich., Detroit—Hoskins Mfg. Co., 4435 Lawton Ave.—miscellaneous equipment for the manufacture of electric furnaces for proposed 1 story addition to factory. Estimated cost $40,000.

Mich., Detroit—Rex Tool Die Co., 5680 12th St.—one shaper.

Mich., Lansing—Fisher Body Corp., General Motors Bldg., Detroit—equipment for handling and finishing automobile bodies for proposed 2 story, 72 x 450 ft. addition to factory on Division St. Estimated cost $250,000.

O., Columbus—Exact Weight Scales Co., 267 West Spring St., K. B. Neff, Factory Supt. — two lathes, drill press, grinding machine, air compressor, etc., for proposed factory on West 5th Ave. Estimated cost $100,000.

O., Delaware—Bd. of Education, will receive bids until Oct. 31 for tools for work shops for proposed 2 story, 110 x 260 ft. high school. Estimated cost $450,000.

Pa., Philadelphia—Day & Zimmerman Engineering & Construction Co., 112 North Broad St. Engrs.—will receive bids until Oct. 28, for motor driven punch press, motor driven 8 ft. power squaring shear and foot press for Trustees Eastern State Penitentiary.

Ont., St. Catharines — Thompson Products Inc., 2196 Clarkwood Rd., Cleveland, O.—equipment for the manufacture of bolts, nuts, cranks and metal parts for automobiles and airplanes for proposed factory on St. Paul St. W. Estimated cost $100,000.

Opportunities for Future Business

Ala., Birmingham — Birmingham Stove & Range Co., Tennessee Pike, plans additional units to plant for the manufacture of heaters and ranges, holloware, grates, etc.

Calif., Fruitvale—Oliver United Filters Co., Inc., 4th and Madison St., Oakland, is having plans prepared for the construction of a factory here. Estimated cost $500,000. Reed & Corlett, Oakland Bank of Savings Bldg., Oakland, Archts.

Calif., San Francisco—Pacific Gas & Electric Co., 445 Sutter St., awarded contract for the construction of a group of 1 story service buildings at Folsom and 18th Sts. Estimated cost $300,000.

Conn., New Haven—City, Municipal Airport Comn., is having plans prepared for the construction of an airport including hangars, shops, etc. Thompson Ave. Estimated cost $325,000. Westcott & Mapes, 130 Orange St., Archts.

Conn., Stratford — Silorsky Aircraft Corp., will soon award contract for a 1 and 2 story, 200 x 250 ft. laboratory. Estimated cost $250,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archt.

Idaho, Boise—Union Pacific Stages, plans the construction of a 1 story, 100 x 125 ft. machine and repair shop.

Ill., Chicago—Hafner Mfg. Co., 3128 Carroll Ave., manufacturers of toys, awarded contract for a 1 story, 100 x 270 ft. factory. Estimated cost $60,000. Noted Oct. 10.

Ind., Auburn—Auburn Automobile Co., will soon award contract for the construction of a 1 and 2 story engineer building.

Ind., Terre Haute—Highland Iron & Steel Co., is having plans prepared for the construction of a new factory. Estimated cost $150,000. Private plans.

Ia., Fort Dodge—City awarded contract for the construction of a machine shop, administration building, etc., in connection with waterworks system.

Ia., Manchester—Mattson Wire & Mfg. Co., H. I. Mattson, Pres., will build a factory for the manufacture of snow fence for use along highways on West Butler St.

Md., Baltimore—Union Tank Car Co., 1600 North Newkirk St., will build a 1 story, 57 x 200 ft. factory.

Md., Baltimore—Flynn & Emrich Co., Holliday and Saratoga Sts., acquired plant of Steinmetz Electric Motor Car Co., Grantley Ave. and Western Maryland Railway, plans a 66 x 125 ft. addition.

Mass., Everett (Boston P. O.) — Warren Foundry & Pipe Co., L. Peckett, awarded contract for foundations for pipe foundry and warehouse on Elvin St. Estimated cost to exceed $40,000. Noted Oct. 17.

Mass., Medford (br. Boston)—Wm. Lacey & Sons Co., 64 Mystic Ave., manufacturers of truck bodies, awarded contract for additions and alterations to factory on Mystic Ave.

Mass., South Walpole — Bird Machine Co., Washington St., awarded contract for the construction of a 1 story addition to boiler shop on Washington St.

Mich., Benton Harbor—B. M. Nowlen & Co., 156 West Main St., is having plans prepared for the construction of a 2 story, 125 x 250 ft. mill work factory. Estimated cost $55,000. H. W. Harper, Fidelity Bldg., Archt.

Mich., Detroit—Detroit Show Case Co., 1654 West Fort St., is having plans prepared for the construction of a 2 story, 60 x 130 ft. factory. Estimated cost $40,000. B. C. Wetzel & Co., Dime Bank Bldg., Archts.

Mich., Detroit—U. S. Aluminum Co., 3311 Dunn Rd., plans the construction of a 1 story, 100 x 380 ft. aluminum parts factory. Estimated cost $75,000. Private plans.

Mich., Marysville—Gar Wood, Inc., Algonac, is having plans prepared for a 1 story, 70 x 350 and 70 x 550 ft. for the manufacture of motor boats and equipment at St. Clair River. Estimated cost $125,000. Private plans.

Mo., St. Louis—Dubinsky Realty Co., 504 Wainwright Bldg., is receiving bids for the construction of a 1 story, 75 x 130 ft. spring factory at 3133 Washington Ave. B. Shapiro, 1219 Syndicate Trust Bldg., Archt. St. Louis Spring Co., 3135 Washington St., lessee.

Mo., St. Louis—McCarthy Chevrolet Co., 6320 Delmar Blvd., acquired a site and plans a 2 story, 110 x 185 ft. automobile sales and service station at Skinker Blvd. and Enright Ave.

N. J., Edgewater—A. Kahn, 1000 Marquette Bldg., Detroit, Mich., Archt., will receive bids until Oct. 28 for the construction of a 2 story, 360 x 1,500 ft. assembly plant at River Rd., here, for Ford Motor Co., E. Ford, Pres., Highland Park, Mich. Estimated cost $1,000,000.

N. J., North Hacksensack — Hackensack Water Co., Main St., is having plans prepared for a 1 story workshop and warehouse at Hackensack Ave. and Temple St. Estimated cost $40,000. C. V. R. Bogert, 210 Main St., Hackensack, Archt.

N. J., Paterson — Firestone Tire & Rubber Co., c/o A. R. Rutan, 306 Lafayette St., Hawthorne, Archt., is receiving bids for a 1 and 2 story sales and service station at Ellison and 18th Sts. Estimated cost $150,000.

N. Y., Brooklyn—Court Sq. Sales & Renting Corp., J. Weinstein, Pres., 26 Court St., had plans prepared for the construction of an 8 story garage at Boerum Pl. and Pacific St. Estimated cost $375,000. J. S. Kennedy, 157 Remsen St., Archt. Noted Oct. 10.

N. Y., Long Island City—Queens County Motor Car Co., 103 Arleigh Rd., Ridgewood, plans the construction of a 6 story, 121 x 259 ft. garage at Barrett St. and Queens Blvd. here. Estimated cost $250,000. H. Brucker, 2424 Myrtle Ave., Archt.

N. Y., New York—Knickerbocker Ice Co., 41 East 42nd St., awarded contract for the construction of a garage and repair shop at 478 West 185th St. Estimated cost $70,000.

N. Y., New York—M. Michaelson, 539 West 47th St., awarded contract for the construction of a garage at 406 West 45th St. Estimated cost $40,000.

O., Barberton—Ric-Wil Co., manufacturers of door hangers, awarded contract for a 1 story 60 x 80 ft. factory. Estimated cost $40,000.

O., Cleveland—City, R. H. Harding, Dir. of Public Service, City Hall, received lowest bid for the construction of a 1 story, 80 x 180 ft. garage and repair shop at East 110th St. and Lever Ave. from Gilchrist Construction Co., Western Reserve Bldg. Estimated cost $100,000. H. Kregelius, City Hall, is architect.

O., Cleveland — Cuyahoga Material Co., L. Soglovitz, Pres., 6311 Kinsman Ave., plans the construction of a 1 story mill, warehouse and garage. Estimated cost $75,000.

O., Sharonville—Crosley Aviation Co., c/o Crosley, Jr., Pres., of Crosley Radio Co., Colerain Ave. and Sassafras St., Cincinnati, awarded contract for the design and construction of first unit of factory, 1 story, 100 x 120 ft., here.

Pa., Bradford — Waddingham Tractor & Equipment Co., 17 Webster St., is receiving bids for a 2 story, 30 x 60 ft. addition to factory on Congress St. Hendryx & Benton, Tidewater Bldg., Archts.

Pa., Butler—A. H. Cohn & Sons, will build a 1 story, 90 x 450 ft. scrap iron plant. Private plans.

Pa., College Hill—Babcock & Wilcox Tube Co., 85 Liberty St., New York, N. Y., will build two 1 story, 100 x 775 and 60 x 560 ft. additions to tube mills in Beaver Co., here. Private plans.

Pa., McKeesport — Columbia Radiator Co., 3200 Walnut St., will build a 1 story, 100 x 200 ft. foundry, machine shop and warehouse. Estimated cost $250,000. Private plans.

Pa., McKees Rocks—Pressed Steel Car Co., H. P. Hoffstat, V. Pres., plans the construction of a 1 story, 60 x 140 and 60 x 100 ft. foundry. Private plans.

Pa., McKees Rocks—United States Chain & Forging Co., Union Trust Bldg., Pittsburgh, awarded contract for the construction of a 1 story, 75 x 150 ft. bumper factory. Estimated cost $50,000.

Pa., Pittsburgh—Firestone Tire & Rubber Co., South Main St., Akron, will soon receive bids for the construction of a service and distribution plant here. Estimated cost $100,000. Lockwood, Greene Co., East 14th St. and Euclid Ave., Cleveland, O., Archts.

Tenn., Alcoa — Aluminum Co. of America, Oliver Bldg., Pittsburgh, awarded structural steel contract for the construction of an alloy plant here. Estimated cost $2,000,000.

Tenn., Athens—Athens Stove Works, C. L. Williams, Gen. Mgr., plans to double capacity of foundry and machine shop departments.

Tenn., Memphis—Spang-Chalfant & Co., awarded contract for the construction of north storage yards including tool sheds, etc. Estimated cost $100,000.

Tex., San Antonio—U. S. Government, c/o A. W. Parker, Quartermaster, will soon award contract for the construction of an air corps warehouse including machine shop, etc. at Randolph Flying Field.

Wash., Port Angeles—Olympia Forest Products Co., plans the immediate construction of two principal mill buildings. Contracts awarded for pulp and machine building, wharf, and driving 7,000 piles constitute foundation for main structures. Estimated total cost $4,000,000.

Wash., Vancouver — Vancouver Cross Arms Co., plans the immediate establishment of a 70 x 586 ft. cross arm factory.

Ont., Arnprior — Kenwood Mill Ltd., plans addition to plant. Estimated cost $60,000.

Ont., Hamilton — Coffield Electric Washing Machine Co., 80 Park St., N., is having plans prepared for the construction of a 1 story factory. Estimated cost $100,000.

Russia, Sealingrad — Union Soviet Socialist Republica, c/o Arntorg Trading Corp., 261 5th Ave., New York, N. Y., awarded steel and equipment contracts for the construction of a tractor factory here. Estimated total cost to exceed $5,000,000. A. Kahn, 1000 Marquette Bldg., Detroit, Mich., Archt.